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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

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Two indexes—subject and author are included after the abstract section.

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Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ *Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes*
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

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AEROSPACE MEDICINE AND BIOLOGY

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NOVEMBER 2000

51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

20000105060 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France
Operational Issues of Aging Crewmembers *les Consequences Operationnelles du Vieillissement des Equipages*
Operational Issues of Aging Crewmembers; August 2000; 275p; In English; In French; 33rd, 11-14 Oct. 1999, Toulon,, France;
See also 20000105061 through 20000105089; CD-ROM contains full text document in PDF format
Report No.(s): RTO-MP-33; AC/323(HFM)TP/13; ISBN 92-837-0015-5; Copyright Waived; Avail: CASI; A12, Hardcopy; A03, Microfiche; C01, CD-ROM

The Human Factors and Medicine (HFM) Panel held a Symposium on "Operational Issues of Aging Crewmembers" in Toulon, France, from 11 to 14 October 1999. In many NATO countries, the populations in general are aging and military crewmembers are an increasingly older population. In downsizing militaries with scarce resources, the increasing costs of training and the significant experience (also at significant cost) of aging crewmembers make them an increasingly valued commodity, particularly as projected in the militaries of the future. Experience, wisdom, healthy lifestyles, and medical and technological advances seem to compensate to some extent for decreased performance and other adverse effects of aging (physical, physiological and psychological) in many crewmembers. Most "aging" studies have accumulated data on general civilian populations and data on the performance of aging crewmembers in military environments have not been previously summarized and presented on any large scale. Thus, the NATO HFM Symposium on "Operational Issues of Aging Crewmembers" was planned to present available data regarding whether or not healthy lifestyles, technological advances and compensatory factors of aging crewmembers, such as experience, adequately compensate for performance among various types of aging crewmembers (pilots, special crew, divers, etc.). If so, a re-evaluation of age policies for military crewmembers might be justified. The Symposium was divided into 3 sessions to accommodate the various topics related to aging crewmembers working in various stressful military environments. In the Session "Operational Aspects of Aging Crewmembers", papers were presented on G tolerance, jet lag, spinal disease, ECG findings during centrifuge training, hypoxia tolerance and time of useful consciousness during hypobaric flights, and pulmonary function in divers. In the Session on "Aging Crewmembers: Psychological and Cognitive Performance Implications", there were presentations on sleep, working memory, personality, behavior, fatigue, risk taking, safety and mission completion, psychological performance, cognitive and sensory limitations and neuropsychiatric referrals. During the final Session, on "Physiological and Sensory Aspects of Aging", papers were presented on anthrax immunization, growth hormone, endocrine responses to training programs, autonomic cardiovascular control, biochemical-metabolic indices, endothelial dysfunction, intima media thickness, cardiovascular risk factors, visual acuity, ocular problems, intraocular lenses, visual performance during small letter contrast tests and on modern cockpits.

Derived from text

Conferences; Aging (Biology); Age Factor; Research

20000105418 Institute of Nuclear Chemistry and Technology, Warsaw, Poland
Validation of an immunochemical assay for the detection of DNA damage as a tool for biological dosimetry of human exposure to ionizing radiation

Schans, G. P.; Timmerman, A. J.; Wojewodzka, M.; Zaim, J.; Dec. 31, 1997; 21p; In English

Report No.(s): DE98-620820; INCT-14/B/97; No Copyright; Avail: Department of Energy Information Bridge

A method for biological dosimetry based on the immunochemical detection of DNA damage in human white blood cells has been validated. to this end the method developed at TNO (Rijswijk, the Netherlands) was also set up at INCT (Warsaw, Poland).

Blood samples of 11 individuals were irradiated with 0 or 5 Gy of 170 kV X-rays at INCT and analyzed both at INCT and TNO. It appeared that in both laboratories damage could be detected to the same extent. The average background level of DNA damage amounted to 1.0 Gy-eq with an interindividual standard deviation of 0.25 Gy. The contribution of the sample variance to the total variance is only 14%. The radiosensitivity showed only a variation of about 10% and can, therefore, be neglected in estimating the radiation dose from the amount of DNA damage detected.

Author(NTIS)

Deoxyribonucleic Acid; Radiation Dosage; Radiation Damage; Dosimeters; Immunoassay

20000105427 Joint Inst. for Nuclear Research, Div. of Radiation and Radiobiological Research, Dubna, USSR

Mathematical model of the SOS response regulation in wild-type Escherichia coli

Aksenov, S. V.; Dec. 31, 1997; 19p; In English

Report No.(s): DE98-621533; JINR-E-19-97-192; No Copyright; Avail: Department of Energy Information Bridge

Regulation of the SOS response in Escherichia coli, which is a set of inducible cellular reactions introduced after DNA damage, is due to specific interaction of LexA and RecA proteins. LexA protein is a common repressor of the genes of the SOS system, and RecA protein, once transiently activated by the so-called SOS-inducing signal, promotes LexA protein destruction. We have described the SOS regulation by means of differential equations with regard to LexA and RecA concentrations elsewhere. The 'input' function for model equations is the level of the SOS-inducing signal against time. Here we present a means for calculating the concentration of single-stranded DNA (SOS-inducing signal) as a function of time in wild-type cells after ultraviolet irradiation. With model equations one can simulate kinetic curves of SOS regulatory proteins after DNA damage to survey the SOS response kinetics. Simulation of LexA protein kinetics agrees with experimental data. We compare simulated LexA kinetic curves in wild-type and u(nu)r(sup -) mutant bacteria, which is useful in investigating the way u(nu)rABC-dependent excision repair modulates the SOS response kinetics. Possible applications of the model to investigating various aspects of the SOS induction are discussed.

NTIS

Mathematical Models; Deoxyribonucleic Acid

20000107152 Joint Inst. for Nuclear Research, Div. of Radiation and Radiobiological Research, Dubna, USSR

Cytogenetic effects of heavy ions in human lymphocytes

Krasavin, E. A.; Govorun, R. D.; Repin, M. V.; Druzhinin, S. V.; Fedorenko, B. S.; Dec. 31, 1997; 19p; In English; 8th; Space Radiation Health Investigators, 1997, Upton, NY, USA

Report No.(s): DE98-618172; JINR-E-19-97-170; No Copyright; Avail: Department of Energy Information Bridge

One of the important tasks in space radiobiology is the evaluation of the genetic risk of galactic heavy charged particles. Cytogenetic analysis of the cosmonauts' lymphocytes after space flight missions (the duration of missions was 117 - 515 days) reveals the increase of the frequency of different types of unstable chromosomal aberrations. This effect can reflect the action of space radiation and foremost the galactic space radiation on the genetic structures. In this connection it is important to study the peculiarities of the induction of stable chromosomal aberration in human lymphocytes by different types of ionizing radiation. The technique of fluorescence in situ hybridization (FISH) with chromosome-1-specific DNA probe was used to analyse the chromosomal damages after irradiation by nitrogen ions (50 MeV/nucleon) and (gamma)-rays (Cs-137). It is shown that the number of cells with aberrations of chromosome-1 increases and reaches 75% after nitrogen ion and (gamma)-ray irradiation at 3 Gy and 7 Gy, respectively. The total number of aberrations and the frequency of chromosome-1 translocations increase nonlinearly with the dose of (gamma)-rays and linearly after heavy ion irradiation. The high frequency of chromosome-1 deletions was revealed in experiment with heavy ions. The values of the relative biological effectiveness (RBE) of nitrogen ions were (approx)3 on the frequency of chromosome-1 translocations.

NTIS

Heavy Ions; Cytogenesis; Extraterrestrial Radiation; Radiation Effects; Radiobiology; Lymphocytes; Relative Biological Effectiveness (RBE)

20000107172 Universities Space Research Association, Huntsville, AL USA

R6 Hexameric Insulin Complexed with m-Cresol or Resorcinol

Smith, G. David, Hauptman-Woodward Medical Research Inst., Inc., USA; Cizak, Ewa, Hauptman-Woodward Medical Research Inst., Inc., USA; Magrum, Lucy A., Hauptman-Woodward Medical Research Inst., Inc., USA; [2000]; 2p; In English Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

The structures of three R6 human insulin hexamers have been determined. Crystals of monoclinic m-cresol/insulin, monoclinic resorcinol/insulin, and rhombohedral m-cresol/insulin crystals diffracted to 1.9, 1.9 and 1.78 Angstroms, respectively,

and have been refined to residuals of 0.195, 0.179, and 0.200, respectively. In all three structures, a phenolic derivative is found to occupy the phenolic binding site where it forms hydrogen bonds to the carbonyl oxygen of A6 Cys and the nitrogen of A11 Cys. Two additional phenolic derivative binding sites were identified within or between hexamers. The structures of all three hexamers are nearly identical although a large displacement of the N-terminus of one B-chain in both monoclinic structures results from coordination to a sodium ion which is located between symmetry related hexamers. Other minor differences in structure are a consequence of differences in packing in the monoclinic cell as compared to the rhombohedral cell. Based upon the differences in conformation of the B13 Glu side chains in T6, T3R3, and R6 hexamers, the deprotonation of these side chains appears to be associated with the T (right arrow) R conformational transition.

Author

Cresols; Insulin; Molecular Structure

20000108684 Academy of Military Medical Sciences, Inst. of Hygiene and Environmental Medicine, Tianjin, China

Protective Effects of Gangliosides on Cerebral Neuronal Damage of Rat During Acute Hypoxia

Xie, Yin-Zhi, Academy of Military Medical Sciences, China; Zhang, Bo, Academy of Military Medical Sciences, China; Yang, Xi-Ming, Academy of Military Medical Sciences, China; Yin, Zhao-Yun, Academy of Military Medical Sciences, China; Bai, Jing-Wen, Academy of Military Medical Sciences, China; Yang, Hai-Xian, Academy of Military Medical Sciences, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 191-195; In Chinese; Copyright; Avail: Issuing Activity

Objective. to observe the preventive and therapeutic effects of gangliosides on acute altitude hypoxic brain damage. Method Fifteen Wistar rats, weighed 180 approx. 220 g, were randomly divided into 3 groups, hypoxia group A, hypoxia group B and normoxia group. The rats in hypoxia group A were exposed to a simulated altitude of 7000 in for 5 hours and the rats in hypoxia group B were exposed to hypoxia after intraperitoneal administration of mixed gangliosides (100 mg/kg/d) for 3 days. Result. Gangliosides could ameliorate the severity of damage in neuronal bodies, cellular skeletons and synapses, especially in synapses. Conclusion. It is suggested that gangliosides are effective in preventing and treating hypoxic brain damages by decreasing the accumulation of intracellular Ca²⁺, and stabilizing CaM and CaM PKII activity during acute hypoxia.

Author

Altitude Simulation; Brain Damage; Musculoskeletal System; Stabilization; Synapses

20000108688 Air Force General Hospital, Beijing, China

Effect of Acute Hypobaric Hypoxia on Renal Function and Structure in Rats

Dai, Yu, Air Force General Hospital, China; Dai, Da-Jiang, Air Force General Hospital, China; Wang, Zhe, Air Force General Hospital, China; Ren, Qu, Air Force General Hospital, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 215-217; In Chinese; Copyright; Avail: Issuing Activity

Objective. to observe renal damage due to acute hypobaric hypoxia. Method Thirty-six male wistar rats were randomly divided into three groups A, B and C (n = 12 for each). Group A served as control, while groups B and C were exposed to 5000 m altitude for 30 min. Sample of serum and renal tissues were taken from group B rats 20 min and from group C rats 24 h after the exposure respectively. Result. Serum ureanitrogen (BUN) and creatinine (Crea) increased significantly in group B and C rats after exposure to hypoxia (P less than 0.01). Cl(-) and alkaline phosphatase (AKP) in serum also increased (P less than 0.05), but renal endothelin (ET) decreased significantly (P less than 0.01). All changes in group C rats tended to recover to normal level, except Cl which continued to increase. Dilatation of renal vessels was found under optic-microscope, and pathological changes were found in mitochondria and epithelial cells. Conclusion. Acute hypobaric hypoxia might be harmful to renal function and structure.

Author

Hypoxia; Damage; Exposure; Rats; Renal Function

20000108791 NASA Marshall Space Flight Center, Huntsville, AL USA

Biological Molecules: Have Most of Our Problems Already Been Solved?

Downey, James P., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English; Nanotechnology, 24-29 Sep. 2000, Houston, TX, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Evolution has resulted in biological machinery that engineers have great reason to envy and at present can only poorly mimic. This is not just a curiosity as biological systems perform many functions that are desired industrial processes. Examples include photosynthesis, chemosynthesis, energy storage, low temperature chemical conversion, reproducible manufacture of chemical compounds, etc. The bases of biological machinery are the proteins and nucleic acids that comprise living organisms. Each molecule functions as a part of a biological machine. In many cases the molecule can be properly regarded as a stand alone machine of its own. Concepts and methods for harnessing the power of biological molecules exist but are often overlooked in the industrial

world. Some are old and appear crude but are quite effective, e.g. the fermentation of grains and fruits. Currently, there is a revolution in progress regarding the harnessing biological processes. These include techniques such as genetic manipulation via polymerase chain reaction, forced evolution also known as evolution in a test tube, determination of molecular structure, and combinatorial chemistry. The following is a brief discussion on how these processes are performed and how they may relate to industrial and aerospace processes.

Author

Combinatorial Analysis; Molecular Structure; Biochemistry; Cells (Biology); Biomimetics

20000108914 Kansas Univ., Lawrence, KS USA

Photosensitive Probes into the Tubulin Binding Domain of Cryptophycins: Synthesis and Structure-Activity Relationship of C16 Aromatic Side Chain Analogues *Final Report, 1 Jun 1997-31 May 2000*

Eggen, Marijean; Jun. 2000; 31p; In English

Contract(s)/Grant(s): DAMD17-97-1-7051

Report No.(s): AD-A381701; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The cryptophycins are a class of patent tumor selective antimetabolic agents isolated from cyanobacteria of the Nostoc species. Synthetic methodology was developed for the structurally flexible synthesis of cryptophycin-24 analogues via both a modular and a novel acyl lactam macrolactonization approach. Heck coupling methodology was used to introduce various C3'-aromatic substituents as well as a moiety for photolabelling of the tubulin protein.

DTIC

Proteins; Synthesis (Chemistry); Crosslinking; Tumors; Cancer

20000108951 Commonwealth Scientific and Industrial Research Organization, Land and Water, Sydney, Australia

Bioavailability and Chemical Characterization of Thermally Altered Red Pine (*Pinus Resinosa*) Wood

Baldock, J. A., Commonwealth Scientific and Industrial Research Organization, Australia; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The presence of charcoal and charred plant residues has been demonstrated in soils and sediments. In this study the bioavailability of C in unaltered and thermally altered wood was compared with that of glucose and cellulose. The chemistry of the unaltered and thermally altered wood was characterized using a variety of solid-state C-13 nuclear magnetic resonance analyses. Bioavailability of C in the heated wood was related to changes in the chemical composition. Additional information is contained in the original extended abstract.

Author

Cellulose; Chemical Composition; Conifers; Glucose; Organic Materials; Wood; Activity (Biology)

20000108954 Wisconsin Univ., Dept. of Geology and Geophysics, Madison, WI USA

Microbial Populations Sustained by Dissolution of Iron-Silicates

Banfield, Jillian F., Wisconsin Univ., USA; Welch, Susan A., Wisconsin Univ., USA; Santelli, Cara M., Wisconsin Univ., USA; Edwards, Katrina J., Wisconsin Univ., USA; Bond, Philip L., Wisconsin Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

It is widely accepted that oxidation of iron provides metabolic energy for microorganisms living in acidic solutions and that microbial catalysis of iron oxidation controls the rate of dissolution of sulfide minerals in most terrestrial and marine environments. However, the potential importance of ferrous iron released by silicate mineral dissolution as a microbial energy source has received scant attention. In part, this may be attributed to the paucity of data supporting the existence of prokaryotes able to catalyze iron oxidation at near neutral pH. The recent isolation of a diversity of species capable of iron oxidation at circumneutral pH under microaerophilic conditions raises the intriguing possibility that Fe-based lithotrophy may sustain (and may have sustained) microbial populations in a variety of Earth (and possibly extraterrestrial) environments. Recently, we verified that under some conditions, iron silicate dissolution can support substantial microbial populations. In this paper we suggest a method to predict cell numbers that may be sustained by dissolution of Fe-bearing minerals in rocks in fairly typical near surface environments. Additional information is contained in the original extended abstract.

Author

Iron; Metabolism; Microorganisms; Oxidation

20000108960 Geological Survey of Britain, Nottingham, UK

Laboratory Evidence for Possible Microbially-enhanced Smectite Formation

Bateman, K., Geological Survey of Britain, UK; Coombs, P., Geological Survey of Britain, UK; Hama, K., Japan Nuclear Cycle Development Inst., Japan; Hards, V. L., Geological Survey of Britain, UK; Milodowski, A. E., Geological Survey of Britain, UK; West, J. M., Geological Survey of Britain, UK; Wetton, P. D., Geological Survey of Britain, UK; Yoshida, H., Japan Nuclear Cycle Development Inst., Japan; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Microbial activity can have a significant impact on geochemical processes as it can influence mineral dissolution and precipitation, pH, alkalinity and redox. Detailed studies into the subsurface microbiology of Aspo had revealed the presence of many different bacteria in the deep groundwaters including iron and sulphate reducing bacteria, the implications of which are discussed in detail in an earlier study. A series of experiments were conducted as part of a British Geological Survey/Japan Nuclear Cycle (BGS-JNC) collaborative programme to study the rock-water and microbial interactions. Additional information is contained in the original extended abstract.

Author

Bacteria; Clays; Geochemistry; Microbiology; Mineralogy; Diorite

20000108962 Wisconsin Univ., Dept. of Geology and Geophysics, Madison, WI USA

The Role of Iron Metabolizing Organisms in the Iron Geochemical Cycle Revealed by Iron-Isotopic Measurements

Beard, B. L., Wisconsin Univ., USA; Johnson, C. M., Wisconsin Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Metabolic processing of iron by bacteria is a ubiquitous phenomenon and includes organisms that reduce, and organisms that oxidize. The important role that these organisms play in controlling iron geochemical cycling is just now becoming recognized, but their importance in the geologic past is speculative because identification of metabolic processing is often veiled by the long expanse of geologic time. In order to gain a better understanding of how microbial life may have shaped our planet we have developed a biosignature that identifies metabolic processing of iron using the isotopic composition of iron. A double-spike technique that uses conventional thermal ionization mass spectrometry has been developed, iron isotope compositions can be measured to a precision of 0.2 to 0.3 per mil for the Fe-56/Fe-54 ratio. Iron isotope variations are reported as: $\delta \text{Fe-56} \text{‰} = [\text{Fe-56/Fe-54 sample} / \text{Fe-56/Fe-54 standard} - 1] \times 10^3$, the Fe-56/Fe-54 ratio of the standard is equal to 15.7028, the measured ratio of a variety of terrestrial and lunar igneous rocks. Controlled laboratory experiments using the iron-reducing bacteria *Shewanella putrefaciens* grown on a ferrihydrite substrate indicates that metabolically reduced iron has a $\delta \text{Fe-56}$ value that is 1.3 per mil less than that of the starting ferrihydrite composition. In contrast, inorganic iron has a constant Fe isotope composition; the Fe isotope composition measured for a variety of terrestrial and lunar rocks (peridotite to rhyolite) is invariant ($\delta \text{Fe-56} = 0$). The constant isotope composition of inorganic iron provides an ideal base-line for evaluating the importance of metabolically processed iron in the geologic past. The isotope composition of Fe has been measured from a variety of sedimentary environments, including Precambrian banded iron formations and Fe-Mn nodules. The range in Fe isotope compositions from these sedimentary environments is large (the measured range in $\delta \text{Fe-56}$ values is 2.5 per mil, a factor of 10 greater than the analytical uncertainty), and suggests that iron metabolizing bacteria have played an important role in the iron geochemical cycle for much of Earth's history. For example, iron isotope compositional variations measured in individual layers of Precambrian banded iron formations vary systematically. Dark colored, Fe-rich layers have near zero $\delta \text{Fe-56}$ values, whereas, light colored, Fe-poor layers have positive $\delta \text{Fe-56}$ values. The rhythmic variations in Fe isotope compositions measured in banded iron formations is consistent with production of the fine scale layering in banded iron formations by diagenetic alteration by iron-reducing bacteria, as originally proposed by Nealson and Meyers. Variations in Fe isotope compositions measured in Fe-Mn nodules is correlated with major-element nodule compositions. Nodules with compositions consistent with formation by diagenetic pore fluids have negative $\delta \text{Fe-56}$ values (-1.62 to -0.96), consistent with the strong role proposed for metal-reducing bacteria which may mobilize metals in pore fluids. In contrast, nodules that have compositions consistent with formation by hydrogenous accretion have variable $\delta \text{Fe-56}$ values (-1.24 to +0.17). Iron isotope compositions for nodules formed by hydrogenous accretion are correlated with productivity levels in the oceans. Nodules from the low productivity, ice-covered Arctic Ocean have $\delta \text{Fe-56}$ values of about -0.3, as compared to nodules from the higher productivity Pacific Ocean that have $\delta \text{Fe-56}$ values of about -1.2. Bacterial processing of iron produces measurable Fe isotope fractionations and the present data on inorganic Fe indicates that non-enzymatic processes do not produce measurable Fe isotope fractionations. Therefore, the isotope composition of Fe may be uniquely suited as a biosignature for evaluating the role of Fe metabolizing organisms in the geologic past, and as a tool for evaluating if life existed on other planets. Iron isotope variations measured for naturally occurring samples indicate that variations in iron isotope compositions are preserved in nature and these

variations are best interpreted as being a result of biological processes. Current work is focusing on evaluating the magnitude of inorganic iron isotope fractionation through the use of reaction columns and electrochemistry, the scope of biological fractionation of Fe in controlled experiments using a variety of substrates and iron metabolizing organisms, and determining the variation in iron isotope compositions in the solar system by analysis of meteoritic material.

Author

Activity (Biology); Bacteria; Biological Effects; Iron; Iron Isotopes; Biogeochemistry

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Sulfate Reducing Bacteria and Mackinawite Stability

Benning, Liane G., Pennsylvania State Univ., USA; Wilkin, R. T., Pennsylvania State Univ., USA; Konhauser, K. O., Leeds Univ., UK; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Avail: Issuing Activity; Abstract Only

The formation of sedimentary iron monosulphides (mackinawite, greigite) and pyrite is strongly interlinked with bacterial sulphate reduction, and thus with the global geochemical Fe, S and C cycles. The inorganic formation and stability of FeS phases at T is less than 100C has been extensively studied due to their vital importance in the sedimentary pyrite formation processes. However, whether sulphate-reducing bacteria (SRB) are actively or passively involved in this process is equivocal. The main goal of this investigation was, therefore, to study the formation and long term stability of FeS-phases in the presence of ubiquitous SRB's. Additional information is contained in the original extended abstract.

Author

Bacteria; Pyrites; Sulfates; Biogeochemistry

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Quantitative Analysis of Experimental Microbe-Mineral Interactions Using Vertical Scanning White Light Interferometry (VSWLI)

Blake, R. E., Yale Univ., USA; Luetge, A., Rice Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Interest in the interactions between microorganisms and mineral surfaces has greatly intensified in recent years. Although many studies have appeared showing high-resolution images of bacteria and other microorganisms in association with mineral surfaces using optical, electron, confocal, atomic force and other microscopic techniques, few of these studies have reported direct quantitative measurements of reacted mineral surfaces, or of the kinetics of specific microbially-mediated processes. Reactions involving microorganisms at the relatively low-temperatures of most microbial habitats, also involve the action of microbial enzymes and, therefore, are almost certainly dominated by kinetic rather than thermodynamic and equilibrium effects. Thus, precise and accurate determination of the kinetics of microbially mediated reactions of mineral surfaces is crucial to the interpretation and modeling of the contribution of microbial metabolism to geochemical processes. Where microbially-mediated reactions of minerals have been quantified, for example, during some mineral dissolution and metal oxidation studies, reaction rates have usually been based on analyses of bulk solution chemistry and normalization to the total surface area of reacting minerals as measured by gas adsorption (BET). As with abiotic dissolution kinetics experiments, the proper handling of surface area is problematic. A large degree of uncertainty is associated with measurements of bulk BET surface area, and the contribution of actual reactive surface area is not known. Determination of the actual reactive surface area and specific reactive sites on mineral surfaces becomes even more important for microbially-mediated processes where reaction is often localized in microenvironments between bacterial cell walls and mineral surfaces at the site of cell attachment, or may involve a combination of enzymatic and abiotic/inorganic mechanisms with variable effects on the mineral surface depending on solution chemistry, bacterial strain, and growth conditions (e.g., Fe(2+) oxidation). The new analytical technique of vertical scanning white light interferometry (VSWLI) [4], applied herein, complements existing surface analytical techniques by allowing quantitative analysis of surface dynamics during mineral dissolution and growth, and direct determination of reaction rates without the need for measurement of surface area. Reaction rates are determined from the retreat or advance of the actual mineral surface over time, and not from changes in bulk solution chemistry. Importantly, this allows accurate determination of mineral dissolution rates under conditions that result in very low concentrations of dissolved products, or where dissolved components are incorporated into bacterial biomass or trapped via complexation with organic polymers (e.g., glycocalyx). by introducing an internal reference onto the mineral surface, absolute rates may be determined in addition to measurements of the relative changes in surface features. In addition to quantification of mineral surface reactions, VSWLI offers several advantages that are especially critical to the study of microbe-mineral interactions, specifically, a large areal field of view (up to 730 X 580 microns) and a large vertical scan range (up to about 1mm), with near atomic-scale vertical resolution (about 2 nm) for surface features up to 100 microns high. These features complement other surface imaging and analytical techniques such as AFM, which offers higher

resolution for detailed atomic-scale measurements, but a relatively small area of view. We are using VSWLI in quantitative experimental investigations of reaction rates and interactions between bacterial cells and the surfaces of various minerals which may serve as important sources of nutrients, or in energy transfer (electron donors/acceptors), during heterotrophic and lithotrophic growth of microorganisms in nature including phosphate, Fe-oxide, and sulfide minerals. Results of initial culture experiments employing mineral phosphate as a sole P source for bacterial growth show highly localized and preferential colonization/reaction at only certain types of surface features such as fractures and microcracks by *Acinetobacter* ADP1. Microbes may be attracted to these features due to their higher surface energy. Specific coating and treatment of mineral surfaces allows resolution of single cells of *Acinetobacter* as well as associated etch pits using VSWLI, and the evolution of individual, microbially induced features such as pits may be followed over extended periods of time. Investigations of single cells and reaction rates of individual features are especially important in quantifying the spatially heterogeneous processes of microbial cell attachment and interaction with mineral surfaces. Results from additional microbial growth experiments will be presented and rates obtained from microbial and abiotic control systems will be compared.

Author

Bacteria; Cells (Biology); Geochemistry; Microorganisms; Minerals; Quantitative Analysis; Biogeochemistry

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High-Precision Uranium-Lead Geochronological Constraints on Early Animal Evolution

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The past five years have seen intensive efforts by paleontologists, evolutionary and developmental biologists, and geologists to better understand the first appearance and subsequent explosive diversification of animals. At the same time, the recognition and exploitation of thin air-fall ashbeds interlayered with fossil-bearing rocks has allowed the establishment of a high-precision temporal framework of animal evolution. Low laboratory blanks and ultra-small sample analyses can lead to analytical uncertainties that translate to age uncertainties of less than 1 Ma. Although still in its infancy, this framework, when combined with integrated paleontological, chemo-stratigraphic, and geological data will allow evaluation of models that invoke both intrinsic and extrinsic triggers for the Cambrian radiation. New geochronological data from late Neoproterozoic rocks indicate Ediacaran fossils range from at least 572 Ma (Newfoundland) to 543 Ma (Namibia) and perhaps into the Cambrian. Complex trace-fossils occur at least as far back as 555 Ma (White Sea). The number and complexity of trace fossils increases dramatically up to the Cambrian explosion which occurs over approximately a 10 Ma interval (530-520 Ma). While the Neoproterozoic time-scale has been extensively modified in the past six years, one of the remarkable but under appreciated conclusions is that the lower Cambrian is over 30 Ma in duration (543-510 Ma), while the middle and upper Cambrian (510-490 Ma) are only 10 Ma in duration. While we have made progress there is much to do. Critical to understanding the role of extrinsic factors in animal evolution is high-precision calibration of the global chemostratigraphic (C and SR) data. This will allow detailed evaluation of whether sudden isotopic excursions reflect globally synchronous events at the 100-300 ka level or are a reflection of local basinal changes. Outstanding questions remaining to be addressed are: (1) what is the duration and number of late Neoproterozoic glacial events and their relationship to diversity in the fossil record? (2) is the negative delta C-13 excursion at the Cambrian-Precambrian boundary globally synchronous and does it signal the extinction of Ediacaran and the creation of ecological niches for the ensuing Cambrian explosion? (3) can the molecular clock approach for determining divergence times be tested using the temporally well calibrated upper Cambrian and Ordovician fossil record? and (4) can we use the fossil record to quantify rates of morphologic change? Continued integration of high-precision geochronology with biological and paleontological studies will allow new insights into the history of early animal evolution. We believe that in ten years or less this approach should allow discussion of the late Neoproterozoic-Cambrian record at the 100-300 ka level.

Author

Geochronology; Paleontology; Uranium; Biological Evolution; Animals; Lead (Metal)

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Bacteria-promoted Dissolution of a Common Soil Silicate

Brantley, S. L., Pennsylvania State Univ., USA; Liermann, L. J., Pennsylvania State Univ., USA; Kalinowski, B. E., Pennsylvania State Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Fe, Mn, Zn, Ni, Cu, Co, and Mo are each used in bacterial enzymes, coenzymes, and cofactors by common anaerobic and aerobic soil bacteria. While it is well known that bacteria excrete siderophores to extract Fe from their environment, it is not understood how these siderophores attack minerals to provide the Fe(III), nor is it understood how bacteria extract micronutrients other than Fe. In this work we investigated the dissolution of hornblende, a well-known "garbage mineral" that contains many of these micronutrients, in the presence of bacteria. Additional information is contained in the original extended abstract.

Author

Bacteria; Dissolving; Silicates; Soils; Iron

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Effect of Oxalate on the Siderophore Promoted Dissolution of Goethite

Cheah, S.-F., California Univ., USA; Sposito, G., California Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format

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Siderophores are Fe-specific ligands synthesized by microorganisms to acquire Fe under aerobic conditions. The effect of siderophores on iron oxide/oxyhydroxide dissolution (Fe release) kinetics in the presence of other natural organic ligands is not known. Such information is important for an understanding of biogeochemical cycling of Fe and as fundamental background information essential for determination of the effect of siderophores on metal transport. In this study, we investigated the influence of oxalic acid on the dissolution kinetics of goethite in the presence of a trihydroxamate siderophore, Desferrioxamine B (DFO-B). DFO-B is a siderophore synthesized by fungi and bacteria, and oxalic acid is one of the most common biologically produced organic acids in soil environments. Additional information is contained in the original extended abstract.

Author

Low Molecular Weights; Iron Oxides; Ligands

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The Search for the Protostome-Deuterostome Ancestor: Conflict Between Paleontological and Molecular Data

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Analysis of molecular (DNA) sequences via a molecular clock suggests the divergence between the major higher animal clades occurred well before the Cambrian radiation (dates range from 1500-630 Ma depending on the genes involved and the methods of analysis). Yet the fossil record shows no evidence of metazoans prior to 580 Ma, and no evidence of higher clades until 550 Ma. This striking dichotomy between paleontologic and molecular estimates of the age of a critical node in animal evolution has important implications for understanding the Cambrian radiation, rates of molecular sequence evolution and developmental evolution. Recent phylogenies of animal relationships have demonstrated that animals more complex than cnidarians are clustered into three large clades, the deuterostomes (including echinoderms and chordates) and two groups of protostomes (ectodermozoans, including arthropods, and lophotrochozoans, including molluscs, annelids and brachiopods). The common ancestor of these three clades (the protostome-deuterostome ancestor or PDA) occurred in the Neoproterozoic. The age and complexity of this animal is currently disputed. If it occurred well before 600 Ma the divergence of these animal clades is necessarily decoupled from the ecological and environmental events of the Cambrian radiation. If the animal was younger, lineage divergence itself may have played a larger role. Since flies and vertebrates, both well studied by developmental biologists, are maximally separated in recent animal phylogenies, genes found in both groups are descended from genes in the PDA. Developmental studies reveal a large suite of such genes, but raise questions about their role in the PDA. Resolution of this conflict may require biogeochemical studies capable of recognizing early bilaterians and higher metazoan lineages, either through biomarker studies or other analyses.

Derived from text

Molecular Biology; Biochemistry; Gene Expression; Genes; Deoxyribonucleic Acid; Divergence

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Copper Biomineralization: Towards Quantifying the Effects of Bacteria on Precipitation

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Bacterial cell walls have a high affinity for binding metal cations, and the interface between bacterial cell walls and aqueous solutions can potentially control the distribution of metal cations in geologic systems. Two processes may occur at this interface that influence metal distributions: surface adsorption and surface-induced mineral precipitation. Reversible adsorption of metal cations onto bacterial surfaces is well documented, and previous work by our group demonstrates that surface complexation modeling can accurately account for the metal adsorption. To date there have been no systematic studies of the effects of bacteria on the extent of mineral precipitation. Several studies have demonstrated that bacteria can influence the composition and morphology of the precipitates as well as the rate of precipitation from oversaturated solutions. However, these studies do not unequivocally demonstrate that bacteria enhance the extent of precipitation or cause precipitation at otherwise undersaturated conditions. In order to define and quantify the role of bacteria in the formation of metal (hydr)oxides, we measured Cu adsorption and precipitation onto the surface of *Bacillus subtilis* as a function of pH, aqueous Cu activity, and time. To differentiate between the sorption processes, x-ray absorption fine structure (XAFS) spectroscopy was used to probe the changes in the coordination sphere of Cu as a function of changing solution chemistry. Additional information is contained in the original extended abstract. Derived from text

Copper; Mineralogy; Bacillus; Cells (Biology); Precipitation (Chemistry)

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Hyperthermophilic Microorganisms in Arsenic-rich Hot Springs

Gihring, T. M., Wisconsin Univ., USA; Druschel, G. K., Wisconsin Univ., USA; Banfield, J. F., Wisconsin Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Mineral and water samples from arsenic-rich geothermal environments were characterized. Hyperthermophilic microorganisms were found living at the vents of Growler Hot Spring and Morgan Hot Springs at temperatures in excess of 90 C and As(III) concentrations up to 13.4 ppm. Mineral samples from the Morgan Hot Springs were found to contain the arsenic-sulfide mineral Realgar (As₂S₃). A previous study describes a loss of arsenic as waters flow downstream from the Growler and Morgan Hot Springs. The removal of arsenic from solutions has been attributed to chemical oxidation and subsequent adsorption to streambed sediments. Biological activity may also play an important role in arsenic removal in these environments through either microbial arsenic oxidation resulting in adsorption and/or sulfate reduction leading to arsenic-sulfide precipitation. Additional information is contained in the original extended abstract.

Author

Microorganisms; Arsenic Compounds; Thermophiles; Geothermal Resources; Minerals; Water Sampling

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Experimental Pyritization of Plant Cells

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Our knowledge of plant evolution depends largely on the interpretation of fossilized plant remains. Fossilization through pyritization is an important process which is not well understood. Two possible pathways are conventionally mooted: (i) replacement, in which the original plant microstructure is preserved to molecular dimensions and (ii) infilling, where internal casts of the structure are preserved. In order to test the relative importance of these processes in pyritisation, we carried out an experimental simulation of the process, based on the oxidation of iron (II) monosulfide (FeS) by H₂S. The celery petiole (leaf stalk) was chosen as the reactant plant material because it contains a range of tissues with cell walls of varying composition (cellulose and lignin). The celery was sectioned into about 1cm long chunks, and blanched in boiling de-ionised water for about 30s. Iron (II) monosulfide was first precipitated by saturating the celery for 1 week each in 100ml of 0.1M, (NH₄)₂(Fe(SO₄)₂).6H₂O and 0.2M, (Na₂S).9H₂O. Oxidation of the iron (II) monosulfide was achieved with 0.01M H₂S at 40C in a reaction vessel also containing a pH buffer solution and a Eh poise (pH = 6, Eh = -250mv, 0.01M H₂S generated from (Na₂S).9H₂O by the addition of about 2ml 50% H₂SO₄). The initial iron (II) monosulfide precipitates mainly within the water conducting vessels of the vascular bundles. There is little evidence for migration of FeS into the surrounding parenchyma cells. In contrast, octohedral pyrite crystals, up to 2micron in diameter, are associated with parenchyma cells adjacent to near empty tracheids. The octohedral pyrite crystals are located within the parenchyma cells, within the intercellular space, and within the cell wall cellulose. There is no evidence for the direct replacement of any organic material. Replacement of organic matter by iron sulfides is difficult process to envisage, because of the lack of a common ion. Our original hypothesis was that pyrite fossilization

was a two stage process: pyrite initially precipitated within the cells (infilling) and subsequently replaced organic components as they decayed through microbial activity (replacement). The results from this study indicate that this may not be the case and that the whole process may be a simple single stage process of infilling at both macroscopic and microscopic scales. In this process, apparent replacement is represented by infilling of interstitial spaces in the plant microarchitecture at microscopic dimensions. The process suggests that pyrite formation in this system results from a reaction with aqueous, rather than solid FeS (cf. [4]) and that plant material may catalyze pyrite nucleation. Additional information is contained in the original extended abstract.

Author

Cellulose; Pyrites; Replacing; Crystallization

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Experimental Measurements of Acid-Base Buffering Properties and Metal Sorption by Lichens

Haas, J. R., North Carolina Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Lichens are widely used as natural biomonitors of environmental pollution. These lower plants are formed by the symbiosis of a fungal and one or more photosynthesizing microbial partners, and are ubiquitous in all terrestrial ecosystems, including severe polar and hot desert settings. Lichens are useful as pollution biomonitors because their biomass can strongly concentrate heavy metals, pollutant gases, and radionuclides from aerosol fallout, precipitation, or runoff. Under natural conditions uptake of soluble metal species by lichen biomass can lead to long term storage through the formation of biominerals and trophic cycling of trace elements via lichen herbivory. Lichens lack roots, a vascular system or a protective waxy cuticle, and thus nutrient uptake is accomplished primarily through passive accumulation of incident chemical species from dry or wet deposition, or directly from the growth substrate. Despite strong interest in lichens for environmental monitoring and biogeochemical cycling studies, the chemical properties and mechanisms governing metal uptake and sequestration by these organisms remain unclear. Although previous studies have shown that adsorption mechanisms predominantly govern metal uptake by lichens and free-living fungi, experimental measurements quantifying interactions between dissolved cations and lichen surfaces remain generally unavailable in the literature. Data that exist are largely anecdotal and cannot be generalized to conditions significantly different from those of the experiments. To address this problem a series of experiments was carried out to measure the surface amphoteric properties and Cd, Cu, Pb, La, Nd, and Yb adsorption behavior of lichen biomass. Experimental data were used to develop an equilibrium thermodynamic model of lichen-aqueous interactions. Additional information is contained in the original extended abstract.

Author

Adsorption; Biogeochemistry; Lichens; Sorption; Heavy Metals; Acid Base Equilibrium

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Thermodynamics of H₂ in Anaerobic Microbial Ecosystems

Martens, C. S., North Carolina Univ., USA; Hoehler, T. M.; Alperin, M. J.; Albert, D. B.; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Molecular hydrogen is produced or consumed by an extremely broad variety of bacterially mediated redox reactions, making it a nearly universal carrier of electrons in anoxic ecosystems. In relatively oligotrophic systems, competition for hydrogen among bacteria can maintain its concentration at extremely low levels that correspond to a minimum biologically useful energy. In such situations, variations in hydrogen concentrations become strongly dependent on the bioenergetics of the H₂-consuming bacteria and the response of H₂ to variations in environmental parameters (e.g., temperature, terminal electron acceptor, sulfate concentration, pH) can be related to simple thermodynamic predictions. Similarly, hydrogen concentrations exert thermodynamic control on a range of bacterial processes, causing inhibition, alteration of products, or even complete reversal. A thorough understanding of H₂ thermodynamics thus provides a novel and semi-quantitative framework in which to relate variations in environmental factors to the overall function and emergent properties of anaerobic bacterial ecosystems as a whole.

Author

Thermodynamics; Molecular Dynamics; Molecular Interactions; Hydrogen; Molecular Gases; Oxidation-Reduction Reactions

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Timing of Mammal-like Reptile Extinctions and the Use of Carbon Isotopes in the Study of the Permian/Triassic Boundary

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The Permian/Triassic (P/T) extinction event is the largest of the Phanerozoic, and many possible causal mechanisms have been proposed. Different mechanisms predict different global-scale spatial and temporal patterns of change, but correlation with adequate resolution is difficult to achieve. Many areas lack independently dated material, and litho- and biostratigraphic techniques are often inappropriate due to the physical and environmental separation between sections. Carbon isotope stratigraphy is one of the few means of consistently providing global chronostratigraphic control. The surface ocean mixes on time scales of $10(\text{exp } 4)$ years and, because its carbon isotopic composition is in dynamic equilibrium with the atmosphere (which mixes on much shorter time scales), global $\delta^{13}\text{C}$ excursions should be geologically simultaneous in continental and shallow marine environments. We have found a large $\delta^{13}\text{C}$ excursion that coincides with the P/T boundary in a section from the interior of Pangea. A similar $\delta^{13}\text{C}$ excursion has been described at the P/T boundary from a number of globally distributed marine and coastal nonmarine sections in both organic and inorganic samples. Thus, the P/T boundary event was synchronous across environments ranging from the marine realm to (super)continental interiors. Our $\delta^{13}\text{C}$ data are not as useful for determining the nature or tempo of change. We argue that the nodule results (approx. =10 % shift) are more robust than the tusk results (3-4 % shift), but other studies have reported an excursion ranging from 3 to greater than 10 %. Further, stratigraphic gaps between occurrences of Bethulie nodules compromise our ability to directly access the rate of $\delta^{13}\text{C}$ change or to resolve any possible higher order features of the $\delta^{13}\text{C}$ curve. Our ongoing efforts to confirm the Bethulie curve at other sections and in different C-bearing phases have so far had limited success. The data suggest no long term $\delta^{13}\text{C}$ changes through hundreds of meters of section at the end of the Permian and underscore the need to rigorously test for diagenetic artifacts, but they do not refine the $\delta^{13}\text{C}$ curve across the boundary. To estimate the rate of change at Bethulie, we cite sedimentological and biostratigraphic observations. Within the resolution of sampling, the lowest $\delta^{13}\text{C}$ values coincide with a 15-meter-thick overlap zone between Permian and Triassic taxa. The stratigraphic co-occurrence of these taxa can not be attributed to taphonomic mixing of temporally distinct faunas, and the overlap zone contains several paleosol horizons which would have each required greater than $10(\text{exp } 3)$ years to form. Recent radiometric dates from Chinese marine sections have placed a maximum duration of approx. = $10(\text{exp } 6)$ years for changes across the P/T boundary. Our data show that, although the event was geologically rapid, it was not geologically instantaneous. Existing $\delta^{13}\text{C}$ data do not point to a unique cause for the P/T event, but viable extinction scenarios must explain a large, rapid, negative $\delta^{13}\text{C}$ excursion. Better control on P/T $\delta^{13}\text{C}$ curves could provide additional constraints and would help avoid the potential circularity of using $\delta^{13}\text{C}$ data both for correlation and interpretation. Additional information is contained in the original extended abstract.

Author

Carbon 13; Extinction; Geochronology; Reptiles; Paleobiology; Paleozoic Era; Mesozoic Era

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Dissolution of Aluminum-substituted Goethites by an Aerobic *Pseudomonas Mendocina* Var Bacteria

Maurice, P. A., Kent State Univ., USA; Lee, Y. J., Kent State Univ., USA; Hersman, L., Los Alamos National Lab., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In soil environments, goethite particles often contain Al(3+) substituted for Fe(3+) in octahedrally coordinated sites. Al substitution has been shown to result in a variety of microtopographic, micromorphologic, and crystal structure changes as well as changes in abiotic dissolution rates and mineral stability. This study focused on the effects of Al substitution (to 8.8 mol%) on goethite dissolution by an aerobic *Pseudomonas mendocina* var. bacteria. In contrast to dissimilatory iron reducing bacteria (DIRB), this bacteria is not capable of using Fe as a terminal electron acceptor for oxidative phosphorylation. Because the aerobic *P. mendocina* var. bacteria do not utilize Fe as a terminal electron acceptor, they require only micron quantities of Fe, compared to the mM concentrations used by DIRB. Pure and Al substituted goethites were synthesized and analyzed by BET (surface area by gas adsorption), X-ray diffraction, atomic force microscopy (AFM), scanning electron microscopy (SEM) and X-ray photoelectron spectroscopy. Growth experiments conducted in aerobic conditions, in the dark at 22C, showed that maximum microbial growth did not correlate with particle specific surface area. However, microbial growth was observed to increase with increasing Al content of the goethites, as well as decreasing particle size, decreasing multidomainicity, and decreasing particle aspect ratio. Due to the formation of dense biofilms, we were unable to observe dissolution features by AFM. The heterogeneous nature of the biofilms suggested that mineral aggregate structure may be important in determining microbial attachment and dissolution rates. Although the mechanistic reasons behind the observed microbial growth/mineral dissolution trends remain

unknown, it is clear that the microorganisms are well adapted to utilizing Al substituted goethites, as are commonly found in aerobic soils.

Author

Aerobes; Aluminum; Dissolving; Hydroxides; Pseudomonas

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Radiocarbon Evidence for Autotrophic Metabolism in Marine Planktonic Archaea

Pearson, A., Woods Hole Oceanographic Inst., USA; Eglinton, T. I., Woods Hole Oceanographic Inst., USA; Hayes, J. M., Woods Hole Oceanographic Inst., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Numerous recent studies document the presence of archaeoplankton in seawater and raise questions about their metabolic pathways, ecological niches, and impact on marine biogeochemistry. Unlike their relatives that live in regions of high temperature, salinity, acidity, or severe anoxia, these Archaea are non-extremophiles. Ribosomal RNA sequences show a widespread distribution of these organisms in the marine water column, and lipid biomarkers characteristic of Archaea have been found in both the water column and in marine sediments. The organisms themselves have not been isolated or cultured, and as a result, their metabolism remains unknown. Heavy stable carbon isotopic ($\delta C-13$) values previously observed for archaeal lipids could be interpreted as a result of either: (i) heterotrophic uptake of isotopically-enriched algal carbohydrates and proteins or (ii) assimilation of dissolved bicarbonate during autotrophic growth. The two alternatives have fundamentally different implications for the utilization of nutrients and energy within the global ocean. In this work we exploit the gradient in $\Delta C-14$ of water column dissolved inorganic carbon (DIC) to distinguish whether the archaeal lipids preserved in the sediments of Santa Monica and Santa Barbara Basins, California, are reflecting a C-14 enriched, surface water carbon source (currently +70% (sub 0) or whether they are C-14-depleted.

Author

Autotrophs; Metabolism; Plankton; Radioactive Isotopes; Carbon 14; Biogeochemistry; Marine Resources

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Photosynthesis Influences Silica Biomineralization?

Phoenix, V. R., Leeds Univ., UK; Konhauser, K. O., Leeds Univ., UK; Adams, D. G., Leeds Univ., UK; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Several studies suggest that bacterial photosynthesis can control biomineralization by mediating the pH of the surrounding microenvironment. It is believed that the production of hydroxyl ions during photosynthesis creates an alkali environment around the microbe, which may result in the precipitation of epicellular carbonates. In addition to this, the sheath of some cyanobacteria may act as a partial diffusion barrier, causing very high alkalinity levels to build up within the sheath matrix. This has been proposed to result in the formation of calcite spherules inside this extracellular polysaccharide. In this study we consider how such processes may influence bacterial silicification. Bacterial silicification is abundant at many hot spring sites, where the microorganisms are often found encrusted in layers of silica, several micrometers thick. These crusts appear to form from colloids; colloidal silica probably being a dominant component of these supersaturated waters. A recent study has demonstrated that these microbes may still function with such a mineral coating, and it thus follows that they may photosynthetically influence the silicification process. Additional information is contained in the original extended abstract.

Author

Minerals; Photosynthesis; Microorganisms; Silicon Dioxide

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Fatty Acids in Particulates from Conception Bay, Newfoundland: Molecular and Carbon-Isotopic Variations Across the 1996 Spring Bloom

Ramos, C. S., University of the Philippines, Philippines; Parrish, C., Memorial Univ. of Newfoundland, Canada; Quibuyen, T., University of the Philippines, Philippines; Abrajano, T., Memorial Univ. of Newfoundland, Canada; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Molecular variations in the types of fatty acids incorporated by algae into lipids across the spring bloom will have a direct impact on subsequent utilization of this carbon and energy source for the pelagic and benthic food webs. Previous work has also shown that $\delta C-13$ of primary photosynthates is sensitive to the timing of biogenic production because of isotope effects

associated with changes in temperature, DIC concentration, delta C-13 (sub DIC) and algal growth rate. In this work, we examined the molecular (lipid classes and fatty acid molecular distribution) and compound-specific delta C-13 (individual fatty acids) variations across the spring bloom (tow nets and sediment traps) in Conception Bay, Newfoundland to elucidate the transfer of primary photosynthate to benthic and hyperbenthic environments in the Bay. Additional information is contained in the original extended abstract.

Author

Carbon 13; Fatty Acids; Newfoundland; Particulates; Molecular Structure; Spring (Season)

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The Response of Marine Sediment Bacteria to Organic Carbon Input

Rossello-Mora, Ramon, Max-Planck-Inst. fuer Marine Microbiology, Germany; Thamdrup, Bo, Odense Univ., Denmark; Schaefer, Hendrik, Netherlands Inst. for Sea Research, Netherlands; Amann, Rudolf, Max-Planck-Inst. fuer Marine Microbiology, Germany; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Cyanobacterial biomass was added to anaerobic sediment of the Black Sea to simulate the natural input of complex organic substrate that occurs in nature after algae blooms. Sediments were incubated at 0 C, 8 C, and 15 C for 13 days. Metabolic changes were followed by the analysis of total carbon mineralization, sulfate reduction, and ammonium production rates. Microbial community dynamics were measured by several techniques of molecular biology applied to microbial ecology analyses (i.e. fluorescence in situ hybridization, FISH; denaturing gradient gel electrophoresis, DGGE; and sequencing of 16S rDNA PCR products). The addition of organic material resulted in significant changes in the composition of the microbial community at all temperatures tested. Sulfate reduction was the main mineralization process detected. However, fermentative organisms of the Cytophaga-Flavobacterium phylogenetic cluster showed to be the dominant fraction of active organisms. In the present communication we will show how the combination of both biogeochemical process measurements, and molecular microbial ecology analyses can improve our understanding of the function of the microbial communities in ecosystems like marine sediments. The main purpose of our presentation is to encourage the combined use of all these type of analyses, which results may give a much accurate picture of what is really happening in natural environments.

Author

Bacteria; Carbon; Organic Materials; Sediments; Marine Environments; Biogeochemistry; Molecular Biology

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2-Methylhopanoids: Biomarkers for Cyanobacteria and for Oxygenic Photosynthesis

Summons, R. E., Australian Geological Survey Organisation, Canberra, Australia; Jahnke, L. L., NASA Ames Research Center, USA; Hope, J. M., Australian Geological Survey Organisation, Canberra, Australia; Logan, G. A., Australian Geological Survey Organisation, Canberra, Australia; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper reports new biomarker and carbon isotopic data for cultured cyanobacteria, cyano-bacterially- dominated ecosystems and ancient sedi-ments and petroleum. We found that cyanobacteria are the predominant source of a distinctive membrane lipid biomarker, namely 2- methylbacteriohopanepolyol (2-Me-BHP). We then sought evidence for a geochemical record of the fossil hydrocarbon analogues of these compounds (2- methylhopanes) and found a trend toward their in-creased relative abundance in marine sediments going back through geological time to 2500 Ma. We conclude that cyanobacteria were the dominant form of phytoplankton and source of molecular oxygen in the Proterozoic ocean. Extending the geological record of cyanobacteria further to Archean times is now a matter of finding a suitably preserved rock record. Additional information is contained in the original extended abstract.

Author

Cyano Compounds; Bacteria; Oxygen; Photosynthesis; Phytoplankton; Carbon Isotopes; Data Acquisition

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Dynamical Signatures of Living Systems

Zak, M., Jet Propulsion Lab., California Inst. of Tech., USA; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

One of the main challenges in modeling living systems is to distinguish a random walk of physical origin (for instance, Brownian motions) from those of biological origin and that will constitute the starting point of the proposed approach. As conjectured, the biological random walk must be nonlinear. Indeed, any stochastic Markov process can be described by linear Fokker-Planck equation (or its discretized version), only that type of process has been observed in the inanimate world. However, all such processes always converge to a stable (ergodic or periodic) state, i.e., to the states of a lower complexity and high entropy. At the same time, the evolution of living systems directed toward a higher level of complexity if complexity is associated with a number of structural variations. The simplest way to mimic such a tendency is to incorporate a nonlinearity into the random walk; then the probability evolution will attain the features of diffusion equation: the formation and dissipation of shock waves initiated by small shallow wave disturbances. As a result, the evolution never "dies;" it produces new different configurations which are accompanied by an increase or decrease of entropy (the decrease takes place during formation of shock waves, the increase-during their dissipation). In other words, the evolution can be directed "against the second law of thermodynamics" by forming patterns outside of equilibrium in the probability space. Due to that, a specie is not locked up in a certain pattern of behavior: it still can perform a variety of motions, and only the statistics of these motions is constrained by this pattern. It should be emphasized that such a "twist" is based upon the concept of reflection, i.e., the existence of the self-image (adopted from psychology). The model consists of a generator of stochastic processes which represents the motor dynamics in the form of nonlinear random walks, and a simulator of the nonlinear version of the diffusion equation which represents the mental dynamics. It has been demonstrated that coupled mental-motor dynamics can simulate emerging self-organization, prey-predator games, collaboration and competition, "collective brain," etc.

Author

Dynamical Systems; Nonlinear Systems; Random Walk; Mathematical Models

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The Equipment of Using Azolla for O₂-Supplementation and Its Test

Chen, Min, Fujian Academy of Agricultural Sciences, China; Liu, Xia-Shi, Fujian Academy of Agricultural Sciences, China; Liu, Zhong-Chu, Fujian Academy of Agricultural Sciences, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 14-18; In Chinese; Copyright; Avail: Issuing Activity

The Equipment of using Azolla for O₂-supplementation and food-production in future space station was developed and tested. Dog was used as the O₂-consuming animal. The design of this device considered both the requirement of Azolla growth, such as illumination, temperature, humidity, nutrition and biomass harvesting, and also the food supplement, excretion draining and temperature controlling for the dog under the condition of an airtight chamber for a relatively long duration. This device was preliminarily tested for O₂-release by Azolla, and data about O₂-supplement by Azolla were obtained.

Author

Oxygen; Food Production (In Space); Space Stations

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Development of a Ground-Based Experimental Facility for Space Cultivation of Higher Plant

Guo, Shuang-Sheng, Institute of Space Medico-Engineering, China; Wang, Pu-Xiu, Institute of Space Medico-Engineering, China; Hou, Ji-Dong, Institute of Space Medico-Engineering, China; Ai, Wei-Dang, Institute of Space Medico-Engineering, China; Chao, Zhao-Gang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 19-24; In Chinese; Copyright; Avail: Issuing Activity

A ground-based experimental facility was developed for conducting initial ground-based simulation study of Controlled Ecological Life Support System (CELSS). The facility is composed of a main chamber, O₂ and CO₂ composition control subsystems, plant cultivation subsystem and whole data management subsystem. The growth room, being composed of a inner wall of mirror-face stainless steel, holds a volume of 1.8 cubic m and a growing area of 1.2 sq m; electronic fluorescent lamps were used as lighting sources and polyvinyl formal was used for root matrixes; the environmental parameters of the growing room such as temperature, relative humidity, O₂ concentration, CO₂ concentration, lighting period and irradiance intensity and the nutrient parameters such as pH, electrical conductivity, dissolved oxygen concentration, liquid level of nutrient storage tank and flow rate of nutrient were all controlled automatically; all of the above mentioned parameters can be inspected, collected, stored and printed regularly and dynamically. The results of a combined debugging and preliminary plant cultivation verified that the technical target of the facility had reached its initial design requirements, it can be used to conduct ground-based simulation studies of space cultivation of higher plants.

Author

Ground Based Control; Control Systems Design; Aerospace Systems; Closed Ecological Systems; Exobiology; Plants (Botany); Cultivation

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Effect of Ascorbic Acid on Chemiluminescence of Cells Cultivated in Various Concentration of Oxygen

Xue, Jian-Hua, Naval Medical Research Inst., China; Liu, Zhong-Quan, Naval Medical Research Inst., China; Li, Zheng-Nian, Naval Medical Research Inst., China; Chang, Jia-Wen, Naval Medical Research Inst., China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 45-47; In Chinese; Copyright; Avail: Issuing Activity

The purpose of this paper is to investigate the effect of Vitamin C (Vit. C) on the stimulated chemiluminescence of rabbit's pulmonary alveolus macrophage (AM) cultivated in various concentration of oxygen. The AMs from rabbits were cultured in a thermostat in which luminescence from cells can be examined, then air with various concentrations of oxygen were continuously led in the device and the AM's stimulated chemiluminescence by PMA (phorbol myristate acetate) was measured with a chemiluminometer.

Author

Ascorbic Acid; Chemiluminescence

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The 'Pro-Drug' RibCys Decreases The Mutagenicity of High LET Radiation in Cultured Mammalian Cells

Lenarczyk, M., Colorado State Univ., USA; Ueno, A., Colorado State Univ., USA; Vannais, D. B., Colorado State Univ., USA; Kraemer, S., Colorado State Univ., USA; Kronenberg, A., California Univ., Lawrence Berkeley Lab., USA; Roberts, J. C., Utah Univ., USA; Tatsumi, K., National Inst. of Radiological Sciences, Japan; Hei, T. K., Columbia Univ., USA; Waldren, C. A., Colorado State Univ., USA; [2000]; 7p; In English, 2000, Unknown; Sponsored by Committee on Space Research, Unknown; Sponsored in part by Utah Regional Cancer Center

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Report No.(s): COSPAR Paper F2.1-0012; Copyright; Avail: Issuing Activity

We have initiated studies aimed at reducing the mutational effects of high LET radiation such as Fe-56 ions and C-12 ions with certain drugs. The mutagenicity of high LET (143 keV/micrometer) Fe-56 or C-12 ions (LET = 100 keV/micrometer) was quantified at the CD59 locus of human-hamster hybrid AL cells. RibCys [2,S)-D-ribo-(1',2',3',4'-Tetrahydroxybutyl)-thiazolidine-4(R)-ca riboxylic acid], formed by condensation of L-cysteine with D-ribose, is designed so that the sulfhydryl amino acid L-cysteine is released intracellularly via nonenzymatic ring opening and hydrolysis leading to increased levels of glutathione (GSH). RibCys (4 or 10 mM), present during irradiation and a few hours post-irradiation, significantly decreased the yield of CD59(-) mutants induced by radiation. RibCys did not affect the clonogenic survival of irradiated cells, nor was it mutagenic itself. These results, together with the minimal side effects reported in mice and pigs, indicate that RibCys may be useful, perhaps even when used prophylactically, in reducing the load of mutations created by high LET radiation in astronauts or other exposed individuals. RibCys is an attractive drug that may reduce the risk of carcinogenesis in people exposed to high LET radiation.

Author

Irradiation; Mutations; Radiation Effects; Mutagens; Cysteamine

20000109823 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Studies on the purification, characterization and structure of antibiotics from centipede using RI labelled compound

Cho, K. S.; Lee, S. M.; Choi, J. S.; Hong, S. W.; Jul. 31, 1997; 35p; In Korean

Report No.(s): DE99-727842; KAERI-CM-152/96; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The substance which has antibiotic properties was extracted by diethyl ether and purified from a centipede *S. subspinipes* by the silicic acid and high S column chromatography. This antibiotics named (sup C)entipedin(sup h)as exhibited a significant antibiotic activity against a variety of microorganism, such as Gram(sup +), Gram(sup -), fungi etc. In connection with the antibiotic property, it was confirmed that its inhibitory effect on the growth of *Staphylococcus aureus* was related with the transcriptional level of DNA and RNA polymerase. The centipedin was measured quantitatively by GC methods and molecular weight was confirmed as 162 Da by mass-spec. Also, molecular formula was identified to C(sub 9)O(sub 3)H(sub 6) by the method of UV, IR and NMR. Antibiotics from centipede did not exhibit any significant cytotoxicity against cancer cell lines, such as HL-60 cell and myeloma cell. It was confirmed that centipedin antibiotics was biosynthesized from (sup 14)C-acetate in vivo experiment.

Author(NTIS)

Purification; Characterization; Molecular Structure; Antibiotics; Microorganisms; Fungi

20000109848 NASA Marshall Space Flight Center, Huntsville, AL USA

Morphology and Viability of Pleistocene Microbiota from the CRREL Permafrost Tunnel Near Fox, Alaska

Hoover, Richard B., NASA Marshall Space Flight Center, USA; [2000]; 1p; In English, 30 Jul - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The U. S. Army Cold Regions Research and Engineering Laboratory maintains the CRREL Permafrost Tunnel at Fox, Alaska (-10 miles north of Fairbanks.) The active microbial ecosystems and the cryopreserved anabiotic viable microorganisms and dead microbial remains and biomarkers frozen within the permafrost and ice of the CRREL Permafrost Tunnel are of direct relevance to Astrobiology. Microbial extremophiles from permafrost and ice provide information concerning where and how should we search for evidence of life elsewhere in the Cosmos. The permafrost and ice wedges of the Fox tunnel preserves a magnificent of record of Pliocene, Pleistocene and Holocene life on Earth spanning more than 2.5 million years. This record includes frozen fossil bacteria, archaea, algae, mosses, higher plants, insects and mammals. In this paper we present the preliminary results of studies of the morphology, ultramicrostructure and elemental distributions of Fox tunnel microbiota as determined in-situ by the Environmental Scanning Electron Microscope (ESEM) and the Field Emission Scanning Electron Microscope (FESEM) investigations. The long-term viability of cryopreserved microbiota and potential implications to Astrobiology will be discussed.

Author

Fossils; Life Sciences; Low Temperature Environments; Microorganisms; Viability; Paleontology; Archaeobacteria; Protobiology; Paleobiology; Cryogenics

20000109875 Enterprise Advisory Services, Inc., Houston, TX USA

Functional Assessment of NK and LAK Cells Following Space Flight

Kaur, Indreshpal, Enterprise Advisory Services, Inc., USA; Pierson, Duane L., NASA Johnson Space Center, USA; [1999]; 1p; In English; Experimental Biology '99, 17-21 Apr. 1999, Washington, DC, USA; Sponsored by Federation of American Societies for Experimental Biology, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Space flight associated stress alters some aspects of the human immune response. In this study, we determined the effects of 10 days aboard the Space Shuttle on the cytotoxic activity of NK and LAK cells. PBMCs were collected from 10-ml blood specimens from 5 astronauts 10 days before launch, immediately after landing, and again at 3 days after landing and stored at -80 C. All PBMCs were thawed simultaneously, and the cytotoxic activities of NK and LAK cells were measured by a 4 hour Cr-51 release assay. K562 cells were used to assess NK cell cytotoxicity. Following 4 days of IL-2 activation, the LAK cell cytotoxic activity was determined using K562 cells and Daudi cells as the target cells. NK cell cytotoxicity decreased at landing ($p < .05$) in 3/5 astronauts, and recovered to preflight levels by 3 days following landing; NK cell cytotoxicity was increased ($p = 0.1$) in the remaining 2 astronauts at landing. In 4/5 astronauts, LAK cytotoxic activity was decreased at landing against K562 cells ($p = 0.13$) and Daudi cells ($p = 0.08$). Phenotyping of PBMC's and LAK cells showed alterations in some surface markers and adhesion molecules (CD11b, CD11c, CD11a, CD16, L-selectin, and CD3).

Author

Cobalt 60; Mars Surface Samples; Sterilization; Mars (Planet); Radiation Dosage; Irradiation; Decontamination

20000110294 Complex Systems Research, Inc., Boulder, CO USA

Terrestrial Cave Microbiota: Models of Martian Subsurface Biology

Boston, P. J., Complex Systems Research, Inc., USA; Northup, D. E., New Mexico Univ., USA; Spilde, M. N., New Mexico Univ., USA; Hose, L. D., Westminster Coll., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Our studies of microbial life in chemically diverse and unusual caves on Earth and the in situ biomineralization that we are observing form a unique basis for constructing a catalog of potential metabolic types, chemical processes, and physical biomarkers of use to future Martian subsurface exploration and study. We will discuss the diverse microbial ecosystems of Earth's subsurface as revealed in the sulfide, carbon dioxide, and relict caves of our studies. We will touch on the salient features of the bizarre means by which they make their livings, including dissolving rock, scavenging from the air, living in sulfuric acid, and using inorganic chemical reactions to provide energy. We will then consider the possibility of such communities in the deep subsurface of Mars and potential exploration methods for studying them based on our field-tested protocols in physically rigorous and hazardous conditions. Additional information is contained in the original extended abstract.

Author

Caves; Microorganisms; Extraterrestrial Life; Exobiology; Aerospace Environments; Mars (Planet); Environment Models

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Aminostratigraphy of Organisms in Antarctic and Siberian Permafrost Cores

Brinton, K. L. F., Jet Propulsion Lab., California Inst. of Tech., USA; Tsapin, A. I., Jet Propulsion Lab., California Inst. of Tech., USA; McDonald, G. D., Jet Propulsion Lab., California Inst. of Tech., USA; Gilichinsky, D., Academy of Sciences (USSR), USSR; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Amino acid racemization dating (or aminostratigraphy) in Antarctic and Siberian permafrost core samples can be used to evaluate the age of organisms in frozen environments. The potential for subsurface permafrost on Mars makes terrestrial permafrost an important source of information regarding the preservation of both living organisms and their remains. Additional information is contained in the original extended abstract.

Author

Preserving; Permafrost; Organisms; Core Sampling; Amino Acids

20000110314 Lockheed Martin Aerospace, Denver, CO USA

Superbug: Make a Living on Current-Day Mars

Clark, Benton C., Lockheed Martin Aerospace, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The martian surface environment is currently so inhospitable that survival and growth is deemed to be impossible. Certainly, no known terrestrial organism could succeed under the myriad constraints and ". . . the probability of growth of a terrestrial organism on present-day Mars is essentially zero." Yet, if life ever did exist on that planet prior to a pervasive but gradual evolution of the climate toward its current hostile form, that life may have evolved likewise sufficiently to find a mode of precarious, albeit not abundant, survival. This report considers some hypothetical possibilities by which it might be feasible for a highly adapted microbe to cope with the adversities presented it. Such a life form, super-adapted to Mars, would be called an extremophile by terrestrial standards, but would find most Earth habitats to be "extreme", and most likely fatal. Additional information is contained in the original extended abstract.

Author

Habitats; Mars Surface; Microorganisms

20000110416 Puerto Rico Univ., Dept. of Physics and Chemistry, Arecibo, Puerto Rico

Biophysical Comparison of the Habitable Zones on Earth and Mars

Mendez, A., Puerto Rico Univ., Puerto Rico; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A planet's habitable zone (HZ) is the spatial and temporal region capable of supporting life. The biosphere (Earth's habitable zone) extends to the near-surface environment (about +/- 10 km with respect to sea level) including part of the atmosphere, hydrosphere and lithosphere. Its extension is also controlled by temporal variations due to daily and seasonal cycles. Bacteria spores have been collected from the air at several kilometers over sea level and barophilic bacteria have been isolated from a deep of 11 km under sea level. These examples show the broad vertical extension of the biosphere. Life is limited in this region at least by the temporal availability of liquid water, and this is controlled by the environment temperature and pressure as described in a water phase diagram. The planet Mars' near-surface environment oscillates between 140 to 300 K with an average atmospheric pressure of 6.1 mbar. There are no Earth examples of microorganisms adapted to similar low temperature and pressure environments because natural examples of such environments are rare or difficult to study. The purpose of this research is to give a global comparison of Earth's and Mars' habitable zones from a biophysical point of view. This biophysical approach includes the construction of a single pressure-temperature (PT-space) diagram combining Earth's and Mars' near-surface environment, a water phase diagram and known microbial habitats. This approach gives a general panorama of the limits of life with respect to temperature and pressure. These two basic environmental variables control the reaction rates, diffusion rates, viscosity, dielectric constant, stresses respond and heat capacities of the cell biochemicals and structures.

Derived from text

Biophysics; Mars Environment; Earth Atmosphere; Ambient Temperature; Atmospheric Pressure; Controlled Atmospheres

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Was It Alive? Distinguishing Biological from Non-Biological Mineralization and Geological Structures

Spilde, M. N., New Mexico Univ., USA; Boston, P. J., Complex Systems Research, Inc., USA; Northup, D. E., New Mexico Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Biologists studying unusual micro-organisms in exotic environments often ask the question "Is it alive?" Geomicrobiologists and mineralogists face an even harder question... "Was it ever alive?" Organisms can leave extensive traces of their presence long after death. of course, the obvious, clear structural fossils are usually the most straightforward to identify. However, other traces of the byproducts of life, e.g. biomineralization, are much more difficult to interpret. In our work in caves, we have discovered many structures and mineral types that appear to be biological or the indirect result of biological activity. Are they? How can we tie these apparent remains to the organisms that may have created them? Even with investigators on site, bringing in equipment, taking samples back to well-equipped, sophisticated scientific laboratories, the status of a natural object as once alive or not alive can be equivocal. How much more difficult, then, will it be to conduct such studies in environments that are unimaginably remote and inaccessible like Mars? We will present examples of materials from our own work that have made us face these questions and detail the methods that we are employing in our ongoing attempts to answer them.

Author

Biology; Activity (Biology); Microorganisms; Minerals

20000110479 Lunar and Planetary Inst., Houston, TX USA

Biomarkers in ALH84001???

Treiman, Allen H., Lunar and Planetary Inst., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format

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D. McKay and colleagues suggested that four sets of features in ALH84001 were biomarkers, signs of an ancient martian biota that once inhabited the meteorite. Subsequent work has not validated their hypothesis; each suggested biomarker has been found to be ambiguous or immaterial. Nor has their hypothesis been disproved. Rather, it is now one of many hypotheses about the alteration of ALH84001. Additional information is contained in the original extended abstract.

Author

Mars (Planet); Meteorites

20000110482 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

Microorganisms from Permafrost Viable and Detectable by 16SRNA Analysis: A Model for Mars

Tsapin, A. I., Jet Propulsion Lab., California Inst. of Tech., USA; McDonald, G. D., Jet Propulsion Lab., California Inst. of Tech., USA; Andrews, M., Jet Propulsion Lab., California Inst. of Tech., USA; Bhartia, R., Jet Propulsion Lab., California Inst. of Tech., USA; Douglas, S., Jet Propulsion Lab., California Inst. of Tech., USA; Gilichinsky, D., Academy of Sciences (USSR), USSR; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Preliminary studies of Arctic and Antarctic permafrost have shown that this environment harbors microorganisms which can be isolated in pure culture, and that these organisms can survive for a long period of time (up to 20 Ma) in permafrost. It is believed that the permanent subzero temperatures in permafrost and ice environments are the main parameters ensuring the longevity of microbes. In this project we studied permafrost cores from different areas of the Siberian Arctic and Antarctic, with ages from several thousand years up to several millions years (Ma). In general, Antarctic permafrost has a higher sand content, while Siberian permafrost has a texture more characteristic of clay or normal soil. Additional information is contained in the original extended abstract.

Author

Clays; Ice Environments; Microorganisms; Permafrost; Subzero Temperature; Models; Mars (Planet)

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Atmospheric Energy Limits on Subsurface Life on Mars

Weiss, B. P., California Inst. of Tech., USA; Yung, Y. L., Jet Propulsion Lab., California Inst. of Tech., USA; Nealson, K. H., Jet Propulsion Lab., California Inst. of Tech., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only;

Available from CASI only as part of the entire parent document

It has been suggested that the terrestrial biomass of subterranean organisms may equal or exceed that at the surface. Taken as a group, these organisms can live in heavily saline conditions at temperatures from 115 C to as low as -20 C. Such conditions might exist on Mars beneath the surface oxidant in an aquifer or hydrothermal system, where the surrounding rock would also protect against the solar ultraviolet radiation. The way that such systems could obtain energy and carbon is not completely clear, although it is believed that on Earth, energy flows from the interaction of highly reduced basalt with groundwater produce H₂, while carbon is derived from CO₂ dissolved in the groundwater. Another potential source is the Martian atmosphere, acting as a photochemical conduit of solar insolation.

Derived from text

Biomass; Extraterrestrial Life; Mars (Planet); Mars Environment; Mars Surface; Organisms; Exobiology

20000110491 NASA Johnson Space Center, Houston, TX USA

Identifying Fossil Bacteria in Martian Materials

Westall, F., NASA Johnson Space Center, USA; McKay, D. S., NASA Johnson Space Center, USA; Gibson, E. K., Jr., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Within the next decade, robotic missions are going to Mars with the search for evidence for extant and extinct life as at least one of the mission objectives. Moreover, the first Martian samples will be returned to Earth in 2008. It is therefore imperative that we can be certain that we can identify life in Martian rocks. In this paper we will not be discussing extant life but will concentrate on fossil life.

Derived from text

Fossils; Identifying; Mars (Planet); Bacteria; Extraterrestrial Life; Exobiology

20000110503 NASA Ames Research Center, Moffett Field, CA USA

Life and Death on Mars and Earth

Zahnle, K. J., NASA Ames Research Center, USA; Sleep, N. H., Stanford Univ., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Failure to discover life on Mars has led a great many experts to conclude that it must be hiding. Where? The likeliest hiding places are deep beneath the surface, where geothermal heat could permit liquid water. In this the search for life on Mars parallels the search for water on Mars. Liquid water has been, at least on occasion, a geologically significant presence on the surface. Channels were cut and plains dissected. This water is now hidden, in all likelihood having drained to the base of the porous regolith, where it fills possibly frozen aquifers. Presumably any surviving biota has followed the water from the surface to its hiding places in the deep. Accordingly, we have extended our environmental impact assessment of the environmental hazards posed by large asteroid and comet impacts to Mars, and compare its case to Earth's. In particular, we address the continuous habitability of surface and subsurface environments.

Derived from text

Extraterrestrial Life; Water; Mars Surface; Exobiology; Mars (Planet); Mars Atmosphere

20000110582 NASA Marshall Space Flight Center, Huntsville, AL USA

The Effect of Solution Thermal History on Chicken Egg White Lysozyme Nucleation

Burke, Michael W., Alabama Univ., USA; Judge, Russell A., Alabama Univ., USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; [2000]; 2p; In English; 13th; Crystallization of Biological Macromolecules, May 2000, Sandestin, FL, USA Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Proteins are highly flexible molecules and often exhibit defined conformational changes in response to changes in the ambient temperature. Chicken egg white lysozyme has been previously shown to undergo an apparent structural change when warmed above the tetragonal/orthorhombic phase transition temperature. This is reflected by a change in the habit of the tetragonal and orthorhombic crystals so formed. In this study we show that possible conformational changes induced by heating are stable and apparently non-reversible by simple cooling. Exposure of protein solutions to temperatures above the phase change transition temperature, before combining with precipitant solution to begin crystallization, reduces final crystal numbers. Protein that is briefly warmed to 37 C, then cooled shows no sign of reversal to the unheated nucleation behavior even after storage for 4 weeks at 4 C. The change in nucleation behavior of tetragonal lysozyme crystals, attributed to a structural shift, occurs faster the greater the exposure to temperature above the equi-solubility point for the two phases. Heating for 2 h at 48 C reduces crystal numbers

by 20 fold in comparison to the same solution heated for the same time at 30 C. Thermal treatment of solutions is therefore a possible tool to reduce crystal numbers and increase crystal size. The effects of a protein's previous thermal history are now shown to be a potentially critical factor in subsequent macromolecule crystal nucleation and growth studies.

Author

Chickens; Eggs; Lysozyme; Nucleation; Temperature Effects; Solutions

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Radioprotective Thiolamines WR-1065 and WR-33278 Selectively Denature Nonhistone Nuclear Proteins

Booth, Valerie K., Waterloo Univ., Canada; Roberts, Jeanette C., Utah Univ., USA; Warters, Raymond L., University of Utah Health Sciences Center, USA; Wilmore, Britta H., Utah Univ., USA; Lepock, James R., Waterloo Univ., Canada; Radiation Research; 2000; ISSN 0033-7587; Volume 153, pp. 813-822; In English

Contract(s)/Grant(s): NAG5-4452; NIH-5P30CA42014; NIH-5R29GM22785; Copyright; Avail: Issuing Activity

Differential scanning calorimetry was used to study the interactions of nuclei isolated from Chinese hamster V79 cells with the radioprotector WR-1065, other thiol compounds, and polyamines. Differential scanning calorimetry monitors denaturation of macromolecules and resolves the major nuclear components (e.g. constrained and relaxed DNA, nucleosome core, and nuclear matrix) of intact nuclei on the basis of thermal stability. WR-1065 treatment (0.5-10 mM) of isolated nuclei led to the irreversible denaturation of nuclear proteins, a fraction of which are nuclear matrix proteins. Denaturation of 50% of the total nonhistone nuclear protein content of isolated nuclei occurred after exposure to 4.7 mM WR-1065 for 20 min at 23 C. In addition, a 22% increase in the insoluble protein content of nuclei isolated from V79 cells that had been treated with 4 mM WR-1065 for 30 min at 37 C was observed, indicating that WR-1065-induced protein denaturation occurs not only in isolated nuclei but also in the nuclei of intact cells. From the extent of the increase in insoluble protein in the nucleus, protein denaturation by WR-1065 is expected to contribute to drug toxicity at concentrations greater than approximately 4 mM. WR-33278, the disulfide form of WR1065, was approximately twice as effective as the free thiol at denaturing nuclear proteins. The proposed mechanism for nucleoprotein denaturation is through direct interactions with protein cysteine groups with the formation of destabilizing protein-WR-1065 disulfides. In comparison to its effect on nuclear proteins in isolated nuclei, WR-1065 had only a very small effect on non-nuclear proteins of whole cells, isolated nuclear matrix, or the thiol-rich Ca (2+) ATPase of sarcoplasmic reticulum, indicating that WR-1065 can effectively denature protein only inside an intact nucleus, probably due to the increased concentration of the positively charged drug in the vicinity of DNA.

Author

Amines; Thiols; Antiradiation Drugs; Biopolymer Denaturation; Nuclei (Nuclear Physics)

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Modulation of Radiation-Induced Apoptosis by Thiolamines

Warters, R. L., Utah Univ., USA; Roberts, J. C., Utah Univ., USA; Wilmore, B. H., Utah Univ., USA; Kelley, L. L., Utah Univ., USA; International Journal of Radiation Biology; 1997; ISSN 0955-3002; Volume 72, No. 4, pp. 439-448; In English

Contract(s)/Grant(s): NAGW-4914; NIH-5R29GM44785; 5P30-CA42401; Copyright; Avail: Issuing Activity

Exposure to the thiolamine radioprotector N-(2-mercaptoethyl)-1,3-propanediamine (WR-1065) induced apoptosis in the mouse TB8-3 hybridoma after 60-minute (LD(sub50) = 4.5mM) or during a 20-hour (LD(sub50) = 0.15 mM) exposure. In contrast, a 20-hour exposure to 17 mM L-cysteine or 10 mM cysteamine was required to induce 50 percent apoptosis within 20 hours. Apoptosis was not induced by either a 60-minute or 20-hour exposure to 10 mM of the thiazolidine prodrugs ribose-cysteine (RibCys) or ribose-cysteamine (RibCyst). Thiolamine-induced apoptosis appeared to be a p53-independent process since it was induced by WR-1065 exposure in human HL60 cells. Exposure to WR-1065 (4mM for 15 minutes) or cysteine (10mM for 60 minutes) before and during irradiation protected cells against the induction of both DNA double-strand breaks and apoptosis, while exposure to RibCys (10 mM for 3 hours) did not. Treatment with either WR-1065, cysteine, RibCys or RibCyst for 60 minutes beginning 60 minutes after irradiation did not affect the level of radiation-induced apoptosis. In contrast, treatment with either cysteine, cysteamine or RibCys for 20 hours beginning 60 minutes after irradiation enhanced radiation-induced apoptosis. Similar experiments could not be conducted with WR-1065 because of its extreme toxicity. Our results indicate that thiolamine enhancement of radiation-induced apoptosis is not involved in their previously reported capacity to reduce radiation-induced mutations.

Author

Radiation Effects; Irradiation; Modulation; Apoptosis; Radiation Protection

20000114277 Institute of Space Medico-Engineering, Beijing, China

Effects of Tail Suspension on Learning and Memory Function of Mice

Wu, Da-Wei, Institute of Space Medico-Engineering, China; Shen, Xian-Yun, Institute of Space Medico-Engineering, China; Dong, Qi, Institute of Space Medico-Engineering, China; Wang, Sheng-Ping, Institute of Space Medico-Engineering, China; Cheng, Zhang-Hong, Institute of Space Medico-Engineering, China; Zhang, Shu-Jing, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 244-248; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of simulated weightlessness on learning and memory capability of the brain. Accuracy fraction, error frequency and pass rate were observed among control, restrained control, tail suspended (TS) control, restrained, and tail suspended mice in square water maze tests. and latent period and error time were observed in control and 30 deg. tail suspension mice in step down test. The indices did not change significantly during learning period. Accuracy fraction of tail suspended group was reduced significantly in the tests accpared with pretest values. In step down test, latent period and error time showed no difference between TS 5 h and 2 d in untrained mice, but shortened evidently after TS 2 d and prolonged after TS 7 d in trained mice, which suggested the degradation of learning and memory ability after TS 5 h and 2 d respectively. Acute tail suspension depressed brain's learning ability and quality, while tail suspension of 7 d and 12 d impaired the spatial memory in mice.

Author

Weightlessness Simulation; Mice; Memory; Disorders; Brain

20000114281 Air Force General Hospital, Dept. of Molecular Biology, Beijing, China

A Study of Apoptosis and Related Gene bcl-2 and p53 Expression in Hippocampus of Rats Exposed to Repeated + Gz

Cai, Qing, Air Force General Hospital, China; Zhan, Zhi, Air Force General Hospital, China; Zhu, Mei-Cai, Air Force General Hospital, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 263-266; In Chinese; Copyright; Avail: Issuing Activity

To investigate the role of apoptosis in mechanisms of brain damage induced by repeated + Gz exposures. Twenty concious SD rats were randomly divided into 5 groups. Rats in the control group (n = 4) were exposed to + 1 Gz and rats in the 4 experimental groups (n = 16) were exposed to + 14 Gz for three times, each for 45 seconds with 30 min interval in between. All the + Gz exposed were on an animal centrifuge. The rat brains were taken 30 min, 6 h, 24 h and 48 h after the last centrifuge run and fixed and embeded. The apoptosis and expression changes of related gene bcl-2 and p53 were detected by terminal deoxynucleotide transferase-mediated dUTP nick end labeling (TUNEL) technique and immunohistochemical method, respectively. Apoptotic cells and expression changes of bcl-2 and p53 were observed in CA1 subregion of rat hippocampus taken 6 h after repeated + Gz exposures, but returned to normal after 24 - 48 h. It suggests that apoptosis and expression changes of bcl-2 and p53 in rats hippocampus can be induced by repeated + Gz exposures and the apoptosis is one of the molecular mechanisms of brain damage induced by repeated + Gz exposures. Keywords: positive acceleration; apoptosis; brain damage; bcl-2; p53; immunication; rats

Author

Brain Damage; Centrifuges; Enzymes; Hippocampus

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Effects of Hypoxia on the Growth of Pulmonary Artery Endothelial Cell

Hong, Xin, Academy of Military Medical Sciences, China; Yin, Zhao-Yun, Academy of Military Medical Sciences, China; Sun, Xing-Bin, Academy of Military Medical Sciences, China; Jiu, Jun-Ping, Academy of Military Medical Sciences, China; Xie, Yin-Zhi, Academy of Military Medical Sciences, China; Lu, Yong-Da, Academy of Military Medical Sciences, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 290-293; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypoxia on the growth of pulmonary artery endothelial cell (PAEC). Growth number, growth cycle phase, and the characteristics of endothelial cells(factor VIII related antigen) of PAEC were investigated during hypoxia using the PAEC cultured in vitro as a model. No difference was found between growth numbers of PAEC under hypoxia and that under normoxia conditions during the culture of 48 h(P greater than 0.05). The numbers of positive immunofluoescence PAEC of factor VIII related antigen in hypoxic groups were lower than those in normoxic groups - The cell cycle phase figures showed that the DNA synthetic phase (S phase) in hypoxia 2 hour group was increased significantly, while the pre-synthetic phase(G(sub 0)/G(sub 1)) was decreased as compared with that of normoxic group. However, the S,G(sub 2)M(gap2 and mitotic phase) or G(sub 1)/G(sub 0) stage of hypoxia for 12, 24 or 48 hours group all had no change as compared with those of normoxic group. Growth

of the PAEC changed significantly during hypoxia. Although the quantity and the growth cycle of PAEC showed little change, the quality was degraded seriously that its function as a permeability barrier would be affected.

Author

Hypoxia; Arteries; Deoxyribonucleic Acid

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Changes of POMC Peptides Levels During Hypothermia and Hypoxia in Rats

Mei, Dan, Air Force Medical Coll., China; Xu, Bin, Air Force Medical Coll., China; Lu, Shi-Jie, Air Force Medical Coll., China; Sun, Xin-Qi, Air Force Medical Coll., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 294-297; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypothermia and hypoxia on plasma POW peptides levels in rats. Acute hypobaric hypoxia experiment in 10 C or 20 C environment were carried out in 56 healthy Wistar rats to observe changes of brain beta-EP, plasma beta-EP and ACTH contents determined by radioimmunoassay. Plasma beta-EP and ACTH levels increased more significantly under cold condition than under room temperature (P less than 0.01). Plasma ACTH concentrations after 5 km acute hypoxia exposure under 10 C decreased more significantly than in ground control groups (P less than 0.01). Plasma ACTH and beta-EP levels after 5 km acute hypoxia exposure under 20 C increased more significantly than ground control groups (P less than 0.01). Plasma ACTH levels in all groups at 20 C and plasma beta-EP levels in 5 km group increased more significantly than in the groups under same attitude at 10 C. After acute hypoxia in cold environment, plasma ACTH and beta-EP contents increased and it may have serious effects on body temperature regulation.

Author

Adrenocorticotropin (ACTH); Brain; Exposure; Hypothermia; Radioimmunoassay; Rats

20000114288 Institute of Space Medico-Engineering, Beijing, China

Changes of Femur Minerals and Serum BGP in Hindlimb Unloaded Rats During Convalescence

Wan, Yu-Min, Institute of Space Medico-Engineering, China; Zhang, Man-Fu, Institute of Space Medico-Engineering, China; Cui, Wei, Institute of Space Medico-Engineering, China; Song, Jin-Ping, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 298-300; In Chinese; Copyright; Avail: Issuing Activity

To observe bone mass changes during convalescence after simulated weightlessness. 7-week-old rats were tail-suspended for 21 d then reloaded for 7 d and 21 d to recover, and measured serum BGP. Tail suspension of rats for 21 d caused significant decrease of serum BGP and phosphorus as well as femur minerals. Serum BGP and femur minerals were still lower than control levels, but serum contents of calcium, phosphorus and magnesium increased significantly after reloading for 7 d. Femur minerals and serum BGP, calcium, phosphorus and magnesium returned to control levels after reloading for 21 d. The deficit in femur mineral induced by hindlimb unloading in rats can be restored by return to normal weight bearing. BGP can be used to monitor the case of its recovery.

Author

Bone Mineral Content; Calcium; Femur; Rats; Weightlessness Simulation

20000114292 Institute of Space Medico-Engineering, Beijing, China

Effects of CO₂ Concentration on Growth and Development of Lettuce in Controlled Environment

Guo, Shuang-Sheng, Institute of Space Medico-Engineering, China; Ai, Wei-Dang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 267-271; In Chinese; Copyright; Avail: Issuing Activity

To study the tolerance of lettuce to elevated CO₂ concentration in Controlled Ecological Life Support System (CELSS). Lettuce was cultivated in the Ground-based Experimental Facility for Higher Plant Cultivation in Space (GEFHPCS), in which many parameters were kept unchanged, while concentration of CO₂ was controlled at 5 different levels (2000 approx. 10000 micro mol/mol). During the growing periods, the morphologies of lettuce were observed every day, the replenished amounts of CO₂ to GEFHPCS and water to the nutrient fluid box as well as the amounts of condensed water collected from GEFHPCS were all recorded every day. After harvest, the output and photosynthetic rate were calculated and lots of constituents of lettuce were

analyzed. The growth of lettuce were relatively ideal when CO₂ concentration was at 6000 micro mol/mol, but an obviously withering appearance was found when CO₂ concentration increased 10000 micro mol/ mol this time the output and quality of lettuce were unsatisfactory. It would be optimal when CO₂ concentration is controlled at about 6000 micro mol/mol in a lettuce-cultivating chamber.

Author

Carbon Dioxide Concentration; Vegetables; Growth; Closed Ecological Systems

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AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20000105010 NASA Johnson Space Center, Houston, TX USA

Precision of Four Acoustic Bone Measurement Devices

Miller, Christopher, Wyle Labs., Inc., USA; Rianon, Nahid, Baylor Coll. of Medicine, USA; Feiveson, Alan, NASA Johnson Space Center, USA; Shackelford, Linda, NASA Johnson Space Center, USA; LeBlanc, Adrian, Baylor Coll. of Medicine, USA; [2000]; 3p; In English; 2nd, 1998, USA; Sponsored by International Bone and Mineral Society, Unknown; No Copyright; Avail: Issuing Activity; Abstract Only

Though many studies have quantified the precision of various acoustic bone measurement devices, it is difficult to directly compare the results among the studies, because they used disparate subject pools, did not specify the estimation methodology, or did not use consistent definitions for various precision characteristics. In this study, we used a repeated measures design protocol to directly determine the precision characteristics of four acoustic bone measurement devices: the Mechanical Response Tissue Analyzer (MRTA), the UBA-575+, the SoundScan 2000 (S2000), and the Sahara Ultrasound Bone Analyzer. Ten men and ten women were scanned on all four devices by two different operators at five discrete time points: Week 1, Week 2, Week 3, Month 3 and Month 6. The percent coefficient of variation (%CV) and standardized coefficient of variation were computed for the following precision characteristics: interoperator effect, operator-subject interaction, short-term error variance, and long-term drift. The MRTA had high interoperator errors for its ulnar and tibial stiffness measures and a large long-term drift in its tibial stiffness measurement. The UBA-575+ exhibited large short-term error variances and long-term drift for all three of its measurements. The S2000's tibial speed of sound measurement showed a high short-term error variance and a significant operator-subject interaction but very good values (less than 1%) for the other precision characteristics. The Sahara seemed to have the best overall performance, but was hampered by a large %CV for short-term error variance in its broadband ultrasound attenuation measure.

Author

Bones; Precision; Acoustic Measurement; Aerospace Medicine

20000105042 Department of Health and Human Services, Office of Rural Health Policy, Rockville, MD USA

Exploratory Evaluation of Rural Applications of Telemedicine *Final Report*

Feb. 01, 1997; 90p; In English; Original contains color illustrations

Report No.(s): PB2000-108195; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Office of Rural Health Policy (ORHP), Health Resources and Services Administration (HRSA), Department of Health and Human Services (HHS), and other State and Federal governmental agencies have devoted considerable financial support to rural telemedicine demonstration projects. This project, which was the first nationwide survey of rural telemedicine (not limited to interactive video), examined the status of rural telemedicine. It also developed evaluation tools and methods for agencies and individual programs to use in assessing the contribution of telemedicine to rural health care delivery.

NTIS

Medical Services; Telemedicine; Rural Areas

20000105061 Naval Air Warfare Center, Crew Systems Technology Dept., Patuxent River, MD USA

The Effect of Aircrew Age on +Gz Tolerance as Measured in a Human-Use Centrifuge

Forster, Estrella M., Naval Air Warfare Center, USA; Shender, Barry S., Naval Air Warfare Center, USA; Forster, Estrella C., Center for Health Care Services, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 1-1 - 1-10; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Pilots of high performance military aircraft are often exposed to positive acceleration stress (+Gz). This type of acceleration displaces blood in the head to foot direction. As the pressure in the vessels of the lower body increases, the vessels dilate, and a major portion of the blood from the upper part of the body is translocated to these lower vessels. The pooling of blood in the lower extremities translates into reduced cardiac output provoking the cardiovascular system, mainly by the activation of baroreceptor reflexes, to maintain adequate blood flow to the central nervous system (CNS) and thereby maintain normal brain function. The physiologic symptoms of acceleration stress range from petechia hemorrhages (burst capillaries present in the limbs) to loss of vision and ultimately loss of consciousness with potential fatal consequences when it occurs in flight. Mission effectiveness may also be affected by +Gz stress in that the lack of adequate blood flow to the CNS leads to degraded motor and cognitive performance. This degradation may then lead to aircraft accidents and incidents commonly labeled "pilot error." Hence, aircrew are routinely trained in the human-centrifuge to understand and better tolerate +Gz stress.

Derived from text

Flight Crews; Age Factor; Aging (Biology); Mental Performance; Pilot Performance; Operator Performance

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Evaluation of Crew Members Aging on Jet-Lag Consequences

Lagarde, Didier, Institut de Medicine Aerospatiale Armee, France; Batejat, Denise, Institut de Medicine Aerospatiale Armee, France; Beaumont, Maurice, Institut de Medicine Aerospatiale Armee, France; Sicard, Bruno, Etat-Major de la Marine, France; VanBeers, Pascal, Institut de Medicine Aerospatiale Armee, France; Pierard, Christophe, Institut de Medicine Aerospatiale Armee, France; Ramont, Laurent, Institut de Medicine Aerospatiale Armee, France; Billaud, Philippe, Institut de Medicine Aerospatiale Armee, France; Chauffard, Françoise, Centre de Recherche, France; French, Johnatan, Armstrong Lab., USA; Operational Issues of Aging Crewmembers; August 2000, pp. 3B1-3B4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

Travel across multiple time zones triggers a disruption of the body's circadian timing mechanisms of crew members and military force. It entails a desynchronization syndrome which depends on individual sensitivity. Weakness and sleep disorders are usually affected and cognitive (mood and attention) and physical (power and endurance) performances can be decreased. The purpose of this study is to evaluate a possible effect of age on individual sensitivity for a jet-lag.

Derived from text

Crews; Age Factor; Aging (Biology); Jet Lag; Desynchronization (Biology); Physiological Responses

20000105063 Universidad Complutense, School of Medicine, Madrid, Spain

Age Dependent Alterations Induced by Transmeridian Flights in Airline Pilots

Tresguerres, J. A. F., Universidad Complutense, Spain; Ariznavarreta, C., Universidad Complutense, Spain; Granados, B., Universidad Complutense, Spain; Martin, M., Universidad Complutense, Spain; Villanua, M. A., Universidad Complutense, Spain; Chiesa, J. J., Buenos Aires Univ., Argentina; Golombek, D. A., Buenos Aires Univ., Argentina; Cardinali, D. P., Buenos Aires Univ., Argentina; Operational Issues of Aging Crewmembers; August 2000, pp. 4-1 - 4-5; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Desynchronization among body rhythms and with the environment appears to be linked with jet lag, which may depend on many factors, including age, flight direction and number of time-zones crossed. To analyze this chronobiological state, we performed a multivariate analysis of the circadian system of airline pilots younger and older than 50 years, in Madrid-Mexico-Madrid (-7 time zones, n=12) and Madrid-Tokyo-Madrid (+8 time zones, n=21) flights. Telemetrical devices were used to record pilots' locomotor activity, skin temperature and heart rate, during the flights to and from destiny, and one day after returning to Madrid. In addition the excretion of 6 sulphatoxy melatonin and free cortisol was measured in 6 hourly intervals during the whole period. Time series were analyzed by cosinor and the rhythms were compared by ANOVA and Tukey contrasts. Age (under and over 50 years old) and flight direction groups were considered. Different psychometric tests were carried out at different times of the flights in order to know how pilots are affected by transmeridian flights. Subjective time estimation was also recorded, as well as other psychological variables including anxiety, tiredness and performance. Activity / rest and heart rate rhythms are easily adapted to the new time zones whereas temperature rhythms manifest a rigid response after the phase shifts. Subjective time tended to be overestimated without exhibiting a clear circadian component. Psychometric evaluation showed that desynchronization affects all the pilots. Some results show an age-related variability with more marked influence in younger pilots, while no consistent effects of the flight direction were found.

Author

Age Factor; Aging (Biology); Aircraft Pilots; Jet Lag

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Influence of Age on Alertness and Performance during 3-day cross North-Atlantic Operations

Valk, P. J. L., Aeromedical Inst., Netherlands; Operational Issues of Aging Crewmembers; August 2000, pp. 5-1 - 5-5; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

From literature it is known that a relationship exists between a age and pilot's performance. Furthermore age correlates with shorter sleep, impaired sleep quality, difficulty in adapting to irregular work schedules and rapid time zone transitions. These factors may aggravate the effect of age and lead to impaired performance during flight duties. Data from North-Atlantic operations (59 pilots) were used to investigate the relationship between age and alertness and performance during long haul operations. Pilots were equipped with a palm top computer and an actigraph for subjective and objective measurement of quantity and quality of sleep, alertness, and performance on a vigilance dual-task. During the entire operation, no differences were found on subjective alertness between the younger and older pilots. Vigilance and tracking performance profiles appeared to be similar for both groups. Vigilance performance of older pilots was better after waking up and during the inbound leg. However, tracking performance of this group was worse before bedtime at stopovers and during the inbound leg. Performance was significantly correlated with age, but when correcting for baseline performance (home base), significance almost disappeared. It was concluded that, although performance of older pilots impaired more durin the outbound flight as compared to younger pilots, sleep quantity and quality during the stopover night were sufficient to made them recover, and to perform at an adequate level on the return flight.

Author

Age Factor; Alertness; Wakefulness; Pilot Performance; Flight Fatigue

20000105065 Department of the Air Force, School of Aerospace Medicine, Brooks AFB, TX USA

Spinal Disease in Aviators and Its Relationship to G-Exposure, Age, Aircraft Seating Angle, Exercise and Other Lifestyle Factors

Drew, William Edward Dougherty, Sr., Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 6-1 - 6-9; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Repetitive G-exposures during high-performance (HP) flying have a potential to accelerate the progression of degenerative spinal disease in aviators so exposed. Critical in determining the significance of these G-exposures is the selection of a control group as similar as possible in all other respects to the HP aviators studied.

Author

Spine; Diseases; Aircraft Pilots

20000105066 Aeromedical Inst., Dept. of Research and Development, Soesterberg, Netherlands

Degenerative Changes of the Spine of Pilots of the RNLAf

Hendriksen, Ingrid J. M., Aeromedical Inst., Netherlands; Holewijn, Michael, Aeromedical Inst., Netherlands; Operational Issues of Aging Crewmembers; August 2000, pp. 7-1 - 7-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

During air combat maneuvering under high +G(sub z) forces, the spine is frequently exposed to heavy loads. Therefore, acute in-flight neck injury is a common complaint among pilots flying high performance aircraft. However, not only sudden incapacitation is caused by high performance flying. The frequent and extreme loading of the spine over the years also constitutes a "chronic" strain, which can possibly lead to degenerative changes. In the "normal" population, the prevalence of spinal degeneration is associated with increasing age. However, this deterioration with age may be accelerated by regular exposure to high +G(sub z) forces. The aim of this study was to examine whether F-16 pilots are at an increased risk of (cervical) spine degeneration.

Derived from text

Spine; Degeneration; Deterioration; Back Injuries; Risk

20000105067 Gulhane Military Medical Academy Hospital, Ankara, Turkey

ECG Findings During Centrifuge Training in Different Age Groups of Turkish Air Force Pilots

Alan, M., Gulhane Military Medical Academy Hospital, Turkey; Akin, A., Gulhane Military Medical Academy Hospital, Turkey; Ozkan, M., Gulhane Military Medical Academy Hospital, Turkey; Savasan, M. K., Gulhane Military Medical Academy Hospital, Turkey; Operational Issues of Aging Crewmembers; August 2000, pp. 9-1 - 9-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

One of the important reasons for starting centrifuge training was that G-LOC was found to have an increasing role in aircraft accidents. Turkish Aerospace Medical Center began high sustained G (HSG) centrifuge training for jet pilots in 199 1. ECG monitoring has been done from the beginning, but ECG data was collected for further research for only the last 2 years. Cardiac

dysrhythmias occurring during centrifuge training, which are physiologic responses to high acceleration, have been reported by many investigators. Sekiguguchi et al. found that over 50% of pilots from the Japanese Air Self Defense Force had dysrhythmias during high G training. Whinnery has reported that treadmill stress testing and exposure to +G(sub z) forces produce a comparable incidence of dysrhythmias, but that G forces have a tendency to produce more serious dysrhythmias, such as ventricular tachycardia. These dysrhythmias usually are asymptomatic and resolve rapidly when the subjects return to 1-G environment. In this study we analyzed the ECG abnormalities occurring during centrifuge training.

Derived from text

Centrifuging Stress; Acceleration Tolerance; Gravitational Physiology; Physiological Responses

20000105068 Army Air Corps, Army Aviation, Stockbridge, UK

Territorial Army Aircrew: "The Senior Pilots" are they at Greater Risk?

Braithwaite, Malcolm G., Army Air Corps, UK; Operational Issues of Aging Crewmembers; August 2000, pp. 10-1 - 10-10; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

This paper presents evidence of the operational effects of ageing on British Army aircrew in two areas: a restriction on flying (and other military duties) and accidents due to human factors. The data suggest that the age of Army pilots should not be reduced for operational reasons. There is an underlying trend that, given that pilots with serious medical problems will tend to self-select themselves out of the service reasonably early, the more experienced aviator is both safer in flight and a lesser burden to himself, and the medical services.

Author

Aircraft Pilots; Flight Crews; Age Factor

20000105069 Centro de Instruccion de Medicina Aeroespacial, Preventive Medicine Dept., Madrid, Spain

Age Factor Related to Hypoxia Tolerance

Lopez, J., Centro de Instruccion de Medicina Aeroespacial, Spain; Vallejo, P., Centro de Instruccion de Medicina Aeroespacial, Spain; Rios, F., Centro de Instruccion de Medicina Aeroespacial, Spain; Jimenez, R., Centro de Instruccion de Medicina Aeroespacial, Spain; delValle, J. B., Centro de Instruccion de Medicina Aeroespacial, Spain; Garcia-Alcon, J. L., Centro de Instruccion de Medicina Aeroespacial, Spain; Operational Issues of Aging Crewmembers; August 2000, pp. 11-1 - 11-6; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Hypoxia is one of the biggest challenges that we are facing. We define hypoxia as the absence of adequate supply of oxygen to the tissues. Humans are extremely sensitive and vulnerable to the effects of oxygen deprivation and severe hypoxia can cause a deterioration of the body's functions quickly, even death. According to the ethiology we distinguish four types of hypoxia: Hypoxic Hypoxia is due to a reduction of the arterial blood oxygen, Anaemic Hypoxia is due to the reduction in the oxygen-carrying capacity of the blood, Ischaemic Hypoxia is the result of the decrease of the sanguine flow in the tissues and Histotoxic Hypoxia is the result of an interference with the ability of the tissues to utilize a normal oxygen supply for oxidative processes.

Derived from text

Age Factor; Hypoxia; Oxygen Consumption; Deprivation

20000105070 Portuguese Air Force Aeromedical Center, Lisbon, Portugal

Time of Useful Consciousness in Crewmembers During Hypobaric Chamber Flights

Ribeiro, Numo, Portuguese Air Force Aeromedical Center, Portugal; Rocha, Carlos, Portuguese Air Force Aeromedical Center, Portugal; Alves, Joaquim, Portuguese Air Force Aeromedical Center, Portugal; Operational Issues of Aging Crewmembers; August 2000, pp. 12-1; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

The authors studied the times of hypoxia in 43 Portuguese Air Force military people, during hypobaric training chamber flights. The times were measured since the moment the trainees took off the oxygen mask until they began to breath again 100% oxygen, this time being considered as the time of useful consciousness. The hypobaric chamber flights take place during the basic and refreshment physiological training courses of our crewmembers, according STANAG 3114.

Derived from text

Consciousness; Flight Crews; Hypoxia; Oxygen Consumption

20000105071 Unidad de Investigacion Subacuatica, Centro de Buceo de la Armada, Murcia, Spain

Pulmonary Function in a Diving Population Aged over 40 Years Old: A Cross-Sectional Study

Olea, A., Unidad de Investigacion Subacuatica, Spain; Gonzalez, J. D., Unidad de Investigacion Subacuatica, Spain; Arance, I., Unidad de Investigacion Subacuatica, Spain; Pujante, A., Unidad de Investigacion Subacuatica, Spain; Viqueira, A., Unidad de

Investigacion Subacuatica, Spain; Operational Issues of Aging Crewmembers; August 2000, pp. 13-1 - 13-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Professional military divers are exposed to high pressure levels for a long time. This high pressure is going to have an effect on the diver and on the respiratory mixture that he is going to breath. The consequences of this high pressure level are the following: High oxygen partial pressure, an increase in the density of the mixture that will be proportional to the depth. All these different aspects can produce modifications in the pulmonary volume and flows that can be observed by spirometric test.

Author

Pulmonary Functions; Lungs; Spirometers; Diving (Underwater); Underwater Tests; Human Tolerances

20000105073 Dundee Univ., School of Social and Health Sciences, UK

Working Memory, Age, Crew Downsizing, System Design and Training

Cook, Malcolm J., Dundee Univ., UK; Operational Issues of Aging Crewmembers; August 2000, pp. 15-1 - 15-13; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

Working memory is a central component of many models of cognitive function and workload (c.f. Baddeley and Gathercole, 1993). The ability to store information on a short-term basis for rapid retrieval or to retain cues to aid recall of long-term information is often presented as a major bottleneck in human performance. Some models of human information processing (Pashler, 1998) place the bottleneck in the central processing phase between input and output and relate it to sequential processing, response selection or limited capacity processing, via a central executive. Many models of attention place the bottleneck between early in stimulus processing (Broadbent, 1957) or at both early and late stimulus processing (Norman, 1968). Wherever the bottleneck exists, or if its position varies with processing experience or attentional states, there has been a general consensus that the central processing phase is of limited capacity (Broadbent, 1958), from the very earliest work. This short term processing and storage capacity will be called working memory as termed by Baddeley and Hitch (1974). Working memory deals with memory processes and storage held in a quickly accessible store in preparation for processing or during the processing of information, where the store has limited or finite capacity'. Analyses of accidents in safety critical systems suggest that memory lapses are an important source of errors and serve to create fertile conditions for accident development (Redmill and Rajan, 1997).

Derived from text

Memory; Education; Learning; Retention (Psychology); Age Factor; Workloads (Psychophysiology)

20000105074 Etat-Major de la Marine, Antenne Programmes, Toulon, France

Evaluation of the Risk of Age in the Navy Prise de Risque et Vieillesse dans la Marine

Sicard, Bruno, Etat-Major de la Marine, France; Jouve, Elisabeth, Centre Hospitalier Univ. La Timone, France; Couderc, Helene, Centre Hospitalier Univ. La Timone, France; Blin, Olivier, Centre Hospitalier Univ. La Timone, France; Operational Issues of Aging Crewmembers; August 2000, pp. 16-1 - 16-4; In French; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

As human age, decrements of performance may be observed. Efficiency in human/machine interaction is highly dependent on decision-making. Decision-making requires to compare, evaluate and manage risks, therefore, decision-making and risk proneness are related. The purpose of this study is to evaluate the effects of naval crew aging on risk proneness. We tested 130 male navy personnel, age range 19-41 years, with EVAR, a visual analogue scale designed to rate risk proneness. EVAR is composed of 24 items distributed among 5 factors: F1 "self control", F2 "danger-seeking", F3 "energy", F4 "impulsiveness" and F5 "invincibility". When looking at other human factor studies, F1, F4 and F5 are the more relevant factors to safety issues. We observed a significant negative correlation between F3 "energy" and aging, whereas the other factors were not influenced by age. These results suggest that if navy crews are going to age moderately, within the 1941 years range, risk proneness change is limited and should not be a safety issue in decisionmaking process. Although the decrements in "energy" observed with aging could lower the coping resource toward sleep deprivation and night shift, leading to new watch and rest schedule.

Author

Decision Making; Human Performance; Man Machine Systems

20000105076 Aeronautique Navale, Centre d'Expertise Medicale du Personnel Navigant, Toulon-Naval, France

Pilots Memory and Psychomotor Performance Evaluation in Relation with Age Evaluation des Performances Psychomotrices et Mnesiques des Pilotes en Fonction de l'Age

Taillemite, J. P., Aeronautique Navale, France; Desmants, F., Aeronautique Navale, France; Sicard, B., Aeronautique Navale, France; Niggel, R., Aeronautique Navale, France; Deroche, J., Aeronautique Navale, France; Courtiere, A., Aeronautique Navale, France; Menu, J. P., Aeronautique Navale, France; Operational Issues of Aging Crewmembers; August 2000, pp. 18-1 - 18-6; In French; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Pilots Memory and Psychomotor Performance Evaluation in Relation with Age. Previous studies have shown an age related decrement in the performance of pilots tested in a flight simulator under intense attentional requirements. The purpose of this experiment was to evaluate the relationship between age and aviation related tasks on performance. We tested 31 military and 69 commercial pilots (including 34 former military pilots), age range 23 to 59 years, mean age 40 years old, on SEPIA, a motion based psychomotor evaluation device. SEPIA, similar to a flight simulator, is currently used to screen aviator candidates in the French Navy. A significant correlation was observed between age and psychomotor performance and working memory. Younger pilots tended to perform better than older ones. SEPIA scores were also affected by experience, assessed by total flight time and years of flying. When looking at the different age groups, simulator and memory performance decrements were statistically significant at age 41 and beyond: Type of training and experience, either for fighter, maritime patrol or commercial pilots, did not influence performance. Self graded analysis of simulator performance was in agreement with the real score and not age dependent. These tests did not allow us to evaluate flying skill of the participants, but only psychomotor capacity and adaptation to a new aeronautical environment. However, it is quite valid to take into consideration the age of the pilot when he transitions to another aircraft (after a first performance evaluation, naturally taking into account individual differences).

Author

Aircraft Pilots; Memory; Retention (Psychology); Psychomotor Performance; Pilot Performance

20000105077 Institute for Human Factors TNO, Dept. of Training and Instruction, Soesterberg, Netherlands

Cognitive and Sensory Limitations with Aging

Operational Issues of Aging Crewmembers; August 2000; 8p; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Demographic developments, characterized by 'ungreening' and 'greying' of the population at the same time, necessitate the reconsidering of early retirement schemes in general and possible those of military professionals as well. Keeping people in the services at older ages asks for continued training and education as the only way to keep people fit for the jobs and to prevent that their skills and knowledge become obsolete. Training and education has to be compatible with the sensory and cognitive changes with age as well the tasks and roles ageing people are best suited for. Changes in the sensory functions are undeniable: the eyes have lost their accommodation function at 60 and, due to yellowing of the eye-lens, discrimination of color differences in the blue part of the spectrum is no longer possible. Compared to young people only a third of the energy reaches the retina in older subjects. These kinds of sensory deterioration start already at the age of about twenty and similar patterns can be shown for the auditory and vestibular functions. For cognitive functions a somewhat more differentiated pattern has to be sketched with a lower functioning of working memory but no deterioration or even increasing functionality of the semantic memory and a still growing domain expertise. Despite functional changes, in general no performance decrement in actual work is found. This can be explained in several ways. One is that older people compensate for their reduced capabilities by using different task strategies. This may result in a different pattern of underlying skills used in doing the job. Based on rather scarce research results, especially scarce for the functioning of age, still a number of recommendations for designing training and education for the older professional can be formulated. They derive partly from the sensory degradations with age, partly from the field of adult education. Findings in the latter field can be traced back to the changes in cognitive functioning with age. The challenge, society at large but also the military face, is to make best use of a by necessity growing segment of older professionals, in such a way that also after retirement the older professionals are better prepared for a longer, more independent and active life.

Author

Cognitive Psychology; Cognition; Information Processing (Biology); Mental Performance; Psychomotor Performance; Sensory Perception

20000105079 Royal Defence Medical Coll., Military Medicine, Gosport, UK

Anthrax Immunization in the Older Warrior

World, M. J., Royal Defence Medical Coll., UK; Operational Issues of Aging Crewmembers; August 2000, pp. 22-1 - 22-7; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

When a higher than expected prevalence of adverse reaction was apparent following the first immunization, it was decided to monitor acceptance, adverse reactions, incapacity and antibody responses in 129 mainly caucasian members of a military field hospital during a voluntary programme of anthrax immunization at 0, 3, 6 and 24 weeks. Attempts were made to relate these variables to age. It was found that older warriors were at least as likely as younger colleagues to complete a voluntary anthrax immunization programme. They did not report adverse reactions more frequently at any stage but if an adverse reaction did occur following the first immunization, significant incapacity (inability to lift or to drive) lasting 48 hours in the majority occurred more frequently. There was no evidence that increasing age resulted in a diminished antibody response to anthrax immunization. The only penalty related to age appeared to be the higher prevalence of incapacity if adverse reaction followed the first anthrax

immunization. This could be particularly critical in certain more vulnerable military populations such as aviators if a substantial proportion of personnel were over the age of 30 years and were possibly immune but were considered to require an urgent program of anthrax immunization before deployment.

Author

Infectious Diseases; Immunity; Immunology; Antibodies

20000105080 Universidad Complutense, School of Medicine, Madrid, Spain

Growth Hormone and Aging

Romero, Perez, Universidad Complutense, Spain; delasHeras, N., Universidad Complutense, Spain; Vasquez, S., Universidad Complutense, Spain; Ariznavarreta, C., Universidad Complutense, Spain; Operational Issues of Aging Crewmembers; August 2000, pp. 23-1 - 23-5; In English; See also 20000105060

Contract(s)/Grant(s): CAM08.4/0014/98; Copyright Waived; Avail: CASI; A02, Hardcopy

Growth hormone (GH) is a peptide containing 191 amino acids that is secreted by the acidophilic cells of the pituitary and has a very important action on growth during infancy and adolescence (Devesa et al 1996). to perform this action GH needs the collaboration of a full series of factors such as, thyroid hormones and sexual hormones together with an appropriate nutrition. GH is under the hypothalamic control of two peptides, one stimulating, GHRH firstly discovered in 1.982 (Guillemin et al 1982, Rivier et al 1982), and another inhibitory, somatostatin, that is a tetradecapeptide, discovered in 1973 by Brazeau et al (1973). Interaction between GHRH and somatostatin plays a significant role in the secretion of GH and somatostatin seems to play the major role (Devesa and Tresguerres 1996). GHRH is secreted in peaks as well as somatostatin, both with 180 deg shift, so that the GH peak appears when GHRH levels are high, and somatostatin levels are low. GH disappears from blood when somatostatin values are high in the hypothalamus and GHRH is low (Tanenbaum and Link 1983). This control is exerted so that GH is secreted every 3h approximately, with higher amplitude during the night, actually during slow wave sleep. Some of the actions of GH are exerted through an intermediary product, IGFI, that it is synthesized in the liver and in other tissues under the stimulation of GH (Tresguerres 1996) IGFI is a peptide of 70 amino acids that shows similarities with proinsulin and acts on a paracrine way on the growth plates of the long bones stimulating the multiplication of chondrocytes and determining growth. IGF I generated in the liver under GH stimulation circulates in the blood bound to a series of transport proteins called IGF BPS that are also GH dependent, especially IGFBP 3. However the most important role is exerted by this a peptide, when synthesized locally in a paracrine way (Tresguerres1996).

Derived from text

Hormones; Peptides; Amino Acids; Aging (Biology); Growth; Biological Evolution

20000105081 Institut de Medicine Aerospatiale Armee, Departement de Physiologie Aerospatiale, Bretigny sur Orge, France

Endocrine Response to Training Programs in the Midlife

Operational Issues of Aging Crewmembers; August 2000, pp. 24-1 - 24-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

It has been proposed that regular physical exercise training could delay the normal process of aging and protect against the metabolic disorders of midlife. In order to relate the hormonal response to training and its protective effects, the recent theory on aging are firstly exposed. The role of hormonal changes on aging process is evoked. In the second part, the normal hormonal response to physical exercise and training, are exposed. In the last part, the specificity of hormonal response to training in midlife is used to explain some protective effect of training. The principal effect seem the improvement in insulin sensitivity but the role of training on growth hormone and androgen could be involved in the effect of training on muscle mass and bone density.

Author

Physical Exercise; Aging (Biology); Endocrinology; Endocrine Systems

20000105082 National Center of Hygiene, Medical Ecology and Nutrition, Sofia, Bulgaria

Age Effect on Autonomic Cardiovascular Control in Pilots

Nikolova, R., National Center of Hygiene, Medical Ecology and Nutrition, Bulgaria; Danev, S., National Center of Hygiene, Medical Ecology and Nutrition, Bulgaria; Nantcheva, R., Military Medical Academy, Bulgaria; Vukov, M., National Center of Health Informatics, Bulgaria; Operational Issues of Aging Crewmembers; August 2000, pp. 25-1 - 25-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

The autonomic cardiovascular control was determined as a function of age in 66 military pilots and in 39 referents, both groups aged from 20 to 55 yr. It was assessed by time-domain and frequency-domain heart rate variability (HRV) measures and with some HRV derived indices. Most sensitive to aging process from time-domain HRV measures revealed to be short-term variability and time-domain index, and from frequency-domain HRV measures frequency-domain index. The activity of both

ANS branches was found to decline with age, but a different extent of decrease of sympathetic as compared to parasympathetic activity was observed: sympathetic activity reflected by the spectral power of the R-R intervals in the temperature mediated spectral frequency band (0.01-0.05 Hz) decline more slowly than parasympathetic activity reflected by respiratory sinus arrhythmia - mediated spectral frequency band (0.15-0.50 Hz). As well as such age-desynchronized autonomic cardiovascular control was found only in military pilots but not in referents it is concluded that the aging process in pilots is accelerated due to repetitive and prolonged exposure to persisting stress, caused by the compulsory underload (substantial reduction of flying tasks and physical exercises coinciding with personal interviews). Although the computed Overall Health Risk values in both groups were not substantially deviated from "normal", those in military pilots was significantly higher.

Author

Age Factor; Autonomic Nervous System; Cardiovascular System; Aircraft Pilots

20000105083 Stathogiannis (Evangelos), Athens, Greece

The Association Between Aging and Biochemical-Metabolical Indexes in a Random Personnel Sample of Hellenic Air Force

Stathogiannis, Evangelos, Stathogiannis (Evangelos), Greece; Andrikopoulos, George, Ippokrateion General Hospital, Greece; Dounis, Basilios; Markou, Joannis; Operational Issues of Aging Crewmembers; August 2000, pp. 26-1 - 26-18; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

The prolonged military operational stresses and the increased life expectancy may induce the appearance of several metabolic and cardiovascular disorders. The early diagnosis of these disorders could contribute to their prevention and effective management. This study is a part of a long-term prospective investigation of association between aging and biochemical-metabolical indexes.

Derived from text

Aging (Biology); Biochemistry; Metabolism; Cardiovascular System; Military Operations; Flight Stress (Biology)

20000105084 Institute of Aviation Medicine, Dept. of Functional Diagnostics and Clinical Physiology, Prague, Czechoslovakia
Does Aging or Endothelial Dysfunction Pose a Threat to Military Crewmembers?

Rada, M. A., Institute of Aviation Medicine, Czechoslovakia; Operational Issues of Aging Crewmembers; August 2000, pp. 27-1 - 27-11; In English; See also 20000105060; Copyright Waived; Avail: CASI; A03, Hardcopy

Aging is a physiologic process associated with an increase of health conditions limiting somewhat an aviator's performance abilities generally. What is more, vascular aging is closely linked with an increase in cardiovascular morbidity and mortality. This may be related to cellular changes due to an increased oxidative stress or/and to an impaired release of vasoactive mediators by endothelium cells. Endothelium-dependent relaxation decreases with aging. Consequent cardiovascular changes and damages with or without the presence of other risk factors and bad life style habits may speed up that process. This may lead to clinical manifestation of the disease, grounding, treatment and even to a permanent disqualification from flying duty not surprisingly within the third and fourth decade. Besides aging, which is an independent risk factor per se, there are new scientific discoveries which have refined our understanding of the endothelium dysfunction process complexity. Additionally, it has been proven that some medicaments like HMG-CoA reductase inhibitors, ACE inhibitors and Ca antagonists, particularly those with a long duration of action, improve endothelium function of the coronary circulation in patients with atherosclerosis or hypertension along with an appropriate physical activity, smoking cessation, glucose intake restriction etc. The content of this paper is focused on highlighting new aspects of aging, links between them, mechanisms of action and interaction. The whole process should be seen as a complex of mechanical, humoral, nutritious, metabolic, endocrine and exogenous factors interplay, having a deleterious impact on human health status, crewmembers including. The end-stage occurs more earlier then simply in the course of natural aging process. Better understanding of these facts was contrasted with clinical findings among the group of Czech military aviators primarily treated for hypertension, as well as for hyperlipidemia and hyperuricemia over the past five years. We succeeded in good control of hypertension pharmacologically, but we failed with influencing of other discovered risk factors. No wonder, that prior to ending up this study, three aviators were disqualified for flying duty due to coronary artery disease (CAD) development. Based on comparison of known experimental facts, clinical trial outcomes and our findings, we have tried to formulate possible pathways for changing our minds and defined particular steps in order to reverse the unwanted trends reached so far in the management of cardiovascular diseases. These steps consist of non-pharmacological and pharmacological interventions in crewmembers. The answer to the question at the beginning will be more elucidated and sophisticated steps then formulated at the end of this paper.

Author

Aging (Biology); Cells (Biology); Risk; Armed Forces; Aircraft Pilots; Pilot Performance; Operator Performance

20000105085 Portuguese Air Force Aeromedical Center, Lisbon, Portugal

Study of Cardiovascular Risk Factors and Age-Related Changes in Visual Acuity in Portuguese Air Force Pilots *Etude des Facteurs de Risque Cardiovasculaire et des Changements de l'Acuite Visuelle dus au Vieillessement: Chez les Pilotes de l'Armee de l'Air Portugaise*

Ribeiro, Nuno, Portuguese Air Force Aeromedical Center, Portugal; Correia, Rui, Portuguese Air Force Aeromedical Center, Portugal; Silveira, Simao, Portuguese Air Force Aeromedical Center, Portugal; Laureano, Fatima, Portuguese Air Force Aeromedical Center, Portugal; dosSantos, Climaco, Portuguese Air Force Aeromedical Center, Portugal; Operational Issues of Aging Crewmembers; August 2000, pp. 30-1 - 30-3; In French; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

This work in an attempt to find links between the aging of pilots and a few parameters usually collected in the course of yearly medical fitness tests given in the Aeronautical Medical Center of the Portuguese Air Force (FAP).

Derived from text

Cardiovascular System; Risk; Age Factor; Visual Acuity

20000105086 Department of the Air Force, Aerospace Ophthalmology Branch, Brooks AFB, TX USA

Ocular Problems of the Aging Military Aviator

Tredici, T. J., Department of the Air Force, USA; Ivan, J., Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 32-1 - 32-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

Approximately 20% of all the USAF aviators are now over the age of 40. Over 60% of the U.S. civilian airline pilots are over the age of 40. Because of the age 60 rule, these pilots must retire when they reach 60 years of age. We decided to look at what are the ocular/visual problems that brought our senior USAF aviators to the Consultation Service at the USAF School of Aerospace Medicine at Brooks AFB, Texas. The Consultation Service evaluates all USAF aviators who have a medical problem that threatens their flight status. Following a thorough medical workup, our staff makes a recommendation to the USAF Surgeon Generals' Office. This might be grounding, further treatment, a waiver to return to flight status or change in flight status.

Derived from text

Visual Perception; Visual Acuity; Vision; Eye (Anatomy); Age Factor; Aging (Biology)

20000105087 Department of the Air Force, School of Aerospace Medicine, Brooks AFB, TX USA

Intraocular Lenses in Military Aircrew

Ivan, Douglas J., Department of the Air Force, USA; Tredici, Thomas J., Department of the Air Force, USA; Operational Issues of Aging Crewmembers; August 2000, pp. 33-1 - 33-7; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Modern advances in microsurgical procedures performed on the human eye distinctly stand out as one of the most, if not the most, dramatic advances in medical sciences over the last 75 years. Cataract surgery has emerged as one of the most common surgical procedures regardless of surgical subspecialty. Although attempts to "surgically" remove cataractous lenses can literally be traced back for thousands of years, visual rehabilitation postoperatively would not reach its zenith until development of the intraocular lens (IOL).

Derived from text

Eye (Anatomy); Lenses; Cataracts; Surgery

20000105088 Army Aeromedical Research Lab., Fort Rucker, AL USA

Visual Performance on the Small Letter Contrast Test: Effects of Aging, Low Luminance and Refractive Error

vandePol, Corina, Army Aeromedical Research Lab., USA; Rabin, Jeff, Army Aeromedical Research Lab., USA; Operational Issues of Aging Crewmembers; August 2000, pp. 34-1 - 34-5; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

In this study the visual performance of aviators and a myopic, non-aviator group were compared to determine the effects of aging, available light and refractive error. The chart used is a novel chart called the Small Letter Contrast Test (SLCT) which measures sensitivity to contrast at the moderate to high end of the spatial frequency range near the visual acuity thresholds of most normal observers. All three variables influence visual performance on the SLCT, age having a greater effect on low luminance performance and refractive error having comparable effects on SLCT performance regardless of luminance level. High contrast visual acuity remains fairly stable and normal over the age range tested; however it decreases with increasing refractive error.

Author

Visual Perception; Visual Observation; Aircraft Pilots

20000105190 Chicago Univ., Chicago, IL USA

Few-View Tomographic Reconstruction of Technetium-99m-Sestamibi Distribution for the Detection and Differentiation of Breast Lesions *Annual Report, 15 Jul. 1998-14 Jul. 1999*

LaRiviere, Patrick J.; Chen, Chin-Tu; Aug. 1999; 96p; In English

Contract(s)/Grant(s): DAMD17-97-1-7118

Report No.(s): AD-A381135; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The broad objective of the research is to develop and evaluate methods for the reconstruction of dedicated breast single-photon emission computed tomography (SPECT) scintimammography (SMM) images from a relatively small number of projection views. We have pursued a strategy involving sinogram preprocessing, in which each projection view is first smoothed using Fourier or spline-based techniques and then additional projection views are interpolated, again using Fourier or spline-based techniques, prior to reconstruction by filtered backprojection (FBP). The spline-based projection smoothing technique is a novel application of roughness-penalized nonparametric regression using an explicit Poisson model and is found to be superior to traditional Fourier smoothing techniques. Likewise, the spline-based projection interpolation approach is found to be more accurate in practical situations than the Fourier-based approach. When applied in concert, the two spline-based techniques yield high-quality images from as few as 15 projection views. We have also developed two alternatives to reconstruction by FBP, one based on the direct Fourier method, the other on direct reconstruction from the coefficients of splines fit to the projection views.

DTIC

Mammary Glands; Cancer; Regression Analysis; Computer Aided Tomography; Lesions; Poisson Density Functions; Technetium

20000105428 Joint Inst. for Nuclear Research, Div. of Radiation and Radiobiological Research, Dubna, USSR

Chromosomal damages and mutagenesis in mammalian and human cells induced by ionizing radiations with different LET

Govorun, R. D.; Dec. 31, 1997; 19p; In English; Fundamentals for the Assessment of Risks from Environmental Radiation, Oct. 1997, Brno, Czechoslovakia

Report No.(s): DE98-621534; JINR-E-19-97-208; No Copyright; Avail: Department of Energy Information Bridge

On the basis of literature and proper data the inference was made about essential role of structural chromosomal (and gene) damages in spontaneous and radiation-induced mutagenesis of mammalian and human cells on HPRT-loci. The evidences of increasing role of these damages in the mutagenesis after the influence of ionizing radiations with high LET are adduced. The consequences of HPRT-gene damages have been examined hypothetically. The heterogeneity of mutant subclones on their cytogenetical properties were revealed experimentally. The data reflect a phenomenon of the reproductive chromosomal instability in many generations of mutant cell. The mutagenesis of mammalian cells is also accompanied by the impairment of chromosome integrity with high probability as a stage of appropriate genome reorganization because of changed vital conditions.

NTIS

Chromosomes; Mutagenesis; Aerospace Medicine

20000107108 Air Force Academy, Dept. of Biology, CO USA

High Energy, Ultrashort Pulse Green Laser-Light Exposure of Cultured Human Cells Yields Evidence of DNA Damage
Obringer, John W.; Phipps, Steve; Johnson, Martin D.; Nov. 1999; 13p; In English; Prepared in collaboration with B&J Enterprises, Inc., Colorado Springs, CO and the Air Force Office of Scientific Research, Arlington, VA.

Report No.(s): AD-A381826; USAFA-TR-2000-02; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The use of laser light for targeting devices and weapons has sharply increased the likelihood that aircrew and support personnel will be exposed to laser light during operations. The increased potential for exposure of humans highlights the need for scientifically-based safety standards for laser exposure at the ultrashort pulse lengths. Current safety standards are largely extrapolations of exposure limits at longer pulse lengths using a minimal visible lesion endpoint in the Rhesus monkey retinal model. A non-animal model for assessing laser-light damage to tissue, particularly human, is necessary for obvious scientific, political, and fiduciary reasons. We assessed the sublethal insult to human cells using a tissue culture system for specific genes that have been shown to be important in several biological processes that could lead to cancer or cell death. Using the CAT-Tox (L) (Xenometrix, Inc.) assay, it appears that green (532 nm), picosecond pulses of laser light is sensed and induces several stress response genes, including FOS, a proto-oncogene, in a roughly dose dependent fashion. Numerous other genes were also induced harbingering the presence of DNA damage. This approach provides insight into a more global methodology for characterizing environmental stressors via genetic profiling.

DTIC

Exposure; Laser Beams; Laser Damage; Light Beams; Deoxyribonucleic Acid; Monkeys; Culture Techniques; Genetics; Pulsed

20000108682 Air Force Convalescent Hospital, Qingdao, China

Relation of Pilots Symptoms with Some Physiological Parameters Under Vestibular Stimulus

Tian, Guang-Qing, Air Force Convalescent Hospital, China; Yu, Yao-Rong, Air Force Convalescent Hospital, China; Guo, Sheng-Xuan, Air Force Convalescent Hospital, China; Hu, Su-Wei, Air Force Convalescent Hospital, China; Bai, Gang, Air Force Convalescent Hospital, China; Gai, Yu-Qing, Air Force Convalescent Hospital, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 183-186; In Chinese; Copyright; Avail: Issuing Activity

Objective. to investigate the relation of vestibular stimulus induced symptoms to electrogastrostrogram(EGG), electronystagmogram(ENG), acupoint potential (AP), skin temperature(ST) heart rate variability(HRV) and content of urine hormones. Method. The physiological parameters were recorded before, during and after vestibular stimuli. Graybiel's scoring standard was used, and progressive regression analysis of symptoms and physiological parameters were made. Result. The regression equations were obtained from data before, during and after the stimuli. Conclusion. Three regression equations might be used.

Author

Regression Analysis; Signs and Symptoms; Vestibules; Pilot Performance

20000108683 Institute of Space Medico-Engineering, Beijing, China

Effects of -30 Deg Head Down Tilt on Lung Function

Lu, Li-Li, Institute of Space Medico-Engineering, China; Zhong, Chong-Fa, Institute of Space Medico-Engineering, China; Yang, Jing-Sheng, Institute of Space Medico-Engineering, China; Tao, Ying, Institute of Space Medico-Engineering, China; Zhao, Guo-Xuan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 187-190; In Chinese; Copyright; Avail: Issuing Activity

Objective. to investigate the effects of short-term simulated weightlessness on lung function in healthy males. Method. -30 deg. head down tilt for 45 min was used to simulate short-period weightlessness. Lung function of 12 health males, aged 18 approx. 21, were studied with plethysmography during seating, supine and head down tilt positions. At the same time, blood flow in pulmonary artery and function of right ventricle were measured with Doppler Echo-Cardiography. Comparative analysis was done. Result. As body position changed from seating or supine into head down tilt, FVC, FEV1, FEV1%, MVV, VA and IVC decreased. The change of MVV was the most prominent (P less than 0.000). As the position changed, pulmonary diffusion increased dramatically (DL(sub CO) P less than 0.001, K(sub CO) P less than 0.000). Conclusion. HDT may lead to a decrease of pulmonary ventilation and lung capacity. The increased pulmonary diffusion might be related to uniform distribution of pulmonary blood flow and increased effective pulmonary vascular bed.

Author

Bed Rest; Blood Flow; Cardiovascular System; Head Down Tilt; Health; Pulmonary Functions; Respiratory Physiology; Weightlessness Simulation

20000108685 Navy General Hospital, Beijing, China

Effect of Combined Stress on Plasma CuZn-SOD and Erythrocyte Membrane T-AOC in Pilots During Low Altitude Flight in Summer

Qin, Shi-Zhen, Navy General Hospital, China; Yu, Qi-Fu, Navy General Hospital, China; Ma, Gui-Xi, Navy General Hospital, China; Zhou, Zheng, Navy General Hospital, China; Hao, Wei-Wei, Navy General Hospital, China; Li, Min-Gao, Navy General Hospital, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 200-203; In Chinese; Copyright; Avail: Issuing Activity

Objective. to study the effect of combined stress on plasma CuZn-SOD and erythrocyte membrane total antioxidant capacity (T-AOC) in pilots during low altitude flight in summer. Method. Twenty-four pilots performing bombing for 3 h (45 approx. 53 C, 122 approx. 97 dB in the cabin, 800 approx. 1200 m altitude flight) served as the subjects. Twenty-one ground personnel served as control (27 C in the room). Blood samples were taken from the two groups before flying (6:00), immediately (12:00) and 8 h (20:00) after flying. CuZn-SOD and T-AOC were determined with radioimmunoassay and colorimetry respectively. Result. Plasma CuZn-SOD at above times were 424.70 +/- 284.10, 127.80 +/- 56.23 and 248.83 +/- 160.40 ng/ml respectively in pilots and 142.90 +/- 75.63, 174.22 +/- 104.97 and 262.95 +/- 129.42 ng/ml respectively in the control group. Plasma CuZn-SOD at 6:00 in pilots was higher than that in control group at the same time (P less than 0.01), and the level immediately after flying as lower than those before and 8 h after flying (P less than 0.01, P less than 0.05, respectively). The erythrocyte membrane T-AOC at the above times were 1.837 +/- 0.745, 1.902 +/- 0.613 and 2.185 +/- 0.780 U/mg, respectively, in pilots, and 1.834 +/- 0.713, 1.395 +/- 0.544 and 2.017 +/- 0.427 U/mg, respectively, in control group. T-AOC at 12:00 in pilots was higher than that in control group

at the same time (P less than 0.05). Conclusion. Exposure of pilots to combined stress during low altitude flight in summer may increase free radicals in blood, and it may be an expression of strengthening antioxidant of the body by decrease of plasma CuZn-SOD and increase of erythrocyte membrane T-AOC immediately after flying.

Author

Antioxidants; Blood; Cell Membranes (Biology); Combined Stress; Personnel; Plasmas (Physics)

20000108687 Air Force General Hospital, Beijing, China

Characteristics and Effect of Allergic Rhinitis in Aircrew on Flight

Xu, Xian-Rong, Air Force General Hospital, China; Guo, Li-Ying, Air Force General Hospital, China; Liu, Hua-Feng, Air Force General Hospital, China; Gong, Wei-Xi, Air Force General Hospital, China; Zhang, Yang, Air Force General Hospital, China; Ye, Tao, Air Force General Hospital, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 207-209; In Chinese; Copyright; Avail: Issuing Activity

Objective. to observe the characteristics of allergic rhinitis in aircrew and its effect on flight. Method. Case studies of allergic rhinitis were made in 32 aircrew. Result. There were 20 cases of perennial allergic rhinitis and 12 cases of seasonal allergic rhinitis in 32 aircrew. Twenty-six cases are still in a qualified position to continue their flying job and the other six cases were permanently grounded. Conclusion. Allergic rhinitis in aircrew may affect the flying in aviation or space flight and the flying in aviation or space may induce or aggravate allergic rhinitis.

Author

Aircraft Pilots; Allergic Diseases

20000108689 Air Force Lintong Sanatorium, Lintong, China

Effects of Simulated Weightlessness on Carbohydrate Intake and Serum Lipids

Hu, Yan-Ping, Air Force Lintong Sanatorium, China; Wang, Xin-Zeng, Air Force Lintong Sanatorium, China; Liu, Zhong-Chang, Air Force Lintong Sanatorium, China; Ren, Wen-Hai, Air Force Lintong Sanatorium, China; Wang, Wen-Yu, Air Force Lintong Sanatorium, China; Xu, Ju-Li, Air Force Lintong Sanatorium, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 218-220; In Chinese; Copyright; Avail: Issuing Activity

Objective. to observe the effects of simulated weightlessness on the nutritional state and contents of serum lipids in human. Method. Eighteen healthy men were exposed to 21 d bed rest with - 6 deg head down tilt (HDT - 6). Nutrients intake was calculated and the lipids levels were determined on the first, eleventh and twenty-first day. Result. Intake of the three main nutrients, carbohydrates, protein and fat met the physiological requirement essentially, but carbohydrates intake was significantly reduced in the second week. There were no significant differences among the lipid levels during different periods. Conclusion. Simulated weightlessness may exert a short-term and reversible influence on human nutritional intake except for lipids. Key words: weightlessness simulation; serum lipids; nutrients

Author

Bed Rest; Head Down Tilt; Lipids; Physiology; Weightlessness Simulation

20000108690 Jiaotong Univ., Research Inst. of Biomedical Engineering, Xian, China

Progress of Clinical Application of High Intensity Magnetic Impulse Stimulation

Liu, Hong-Guang, Jiaotong Univ., China; Zhou, Lin, Jiaotong Univ., China; Jiang, Da-Zong, Jiaotong Univ., China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 221-225; In Chinese; Copyright; Avail: Issuing Activity

The application of non-invasive magnetic impulse stimulation in the study of central neurons activities and recovery of neuro-muscular functions is now becoming a new hot subject in bio-medical engineering researches. In this paper, its physical principles, characteristics, practical applications and recent development were reviewed comprehensively.

Author

Muscular Function; Impulses; Stimulation; Magnetic Effects

20000108691 Institute of Space Medico-Engineering, Beijing, China

Analysis and Improvement Consideration of the Current Human Experimental Models of Humoral Regulation in Microgravity

Wang, De-Sheng, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Xiang, Qiu-Lu, Institute of Space Medico-Engineering, China; Sun, Lei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 226-230; In Chinese; Copyright; Avail: Issuing Activity

The main differences between physiological effects of microgravity in spaceflight and simulated microgravity on humans appeared in the circulation of the low pressure side, in humoral and electrolyte metabolism. For a further understanding of the physiological effects of microgravity, some improvement of the current human experimental models are needed. It is possible to choose more adequate models closer to the situation in microgravity through measuring cardiovascular parameters, fluid regulation and renal excretion variables under head-up tilt (HUT) plus lower body positive pressure condition, or under head-down tilt(HDT) plus upper body negative pressure in various angles and pressure levels.

Author

Weightlessness Simulation; Bed Rest; Cardiovascular System; Electrolyte Metabolism; Physiological Effects

20000108692 Institute of Space Medico-Engineering, Beijing, China

The Present Status and Development of Oscillometric Blood Pressure Measurement

Xu, Huai-Xiang, Institute of Space Medico-Engineering, China; Fang, Xing-Ye, Institute of Space Medico-Engineering, China; Xu, Zhi, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 231-234; In Chinese; Copyright; Avail: Issuing Activity

With the wide use of electronic sphygmomanometers, more attention is paid to the study of the method for determining systolic and diastolic blood pressure from oscillometric pulse waves. The paper expatiated it on the basis of different algorithms in this field by dividing them into two categories named as feature point method and amplitude characteristic ratios method. Factors affecting the accuracy of pressure measurement was discussed and the prospect of further development of measuring algorithms was also proposed. Key Words: blood pressure measurement; oscillometric method; measurement methods; amplitude characteristic ratios method

Author

Pressure Measurement; Method of Characteristics; Fabrication; Measuring Instruments

20000108785 NASA Marshall Space Flight Center, Huntsville, AL USA

Crystallization and Initial X-Ray Diffraction Analysis of Human Pyruvate Dehydrogenase

Cizsak, Ewa, NASA Marshall Space Flight Center, USA; Korotchkina, Lioubov G., State Univ. of New York, USA; Hong, Young-Soo, NASA Marshall Space Flight Center, USA; Joachimiak, Andrzej, Argonne National Lab., USA; Patel, Mulchand S., State Univ. of New York, USA; Rose, M. Franklin, NASA Marshall Space Flight Center, USA; [2000]; 2p; In English
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Issuing Activity; Abstract Only

Human pyruvate dehydrogenase (E1) is a component enzyme of the pyruvate dehydrogenase complex. The enzyme catalyzes the decarboxylation of pyruvate followed by a reductive acetylation of lipoyl groups of the dihydrolipoamide acetyltransferase component of the pyruvate dehydrogenase complex. E1 is an alpha(sub 2)Beta(sub 2) tetrameric assembly of an approximate molecular mass of 154 kDa. The crystals of this recombinant enzyme have been grown from polyethylene glycol 3350 using vapor diffusion method at 295K. The crystals are characterized as orthorhombic, space group P2(sub 1)2(sub 1)2(sub 1), with cell parameters of a = 64.2, b = 126.9 and c = 190.2 Å. Crystals diffracted to a minimum d-spacing of 2.5 Å. The asymmetric unit contains one alpha(sub 2)Beta(sub 2) tetrameric E1 assembly, and self-rotation function analysis showed a pseudo-twofold symmetry relating the two monomers.

Author

Crystallization; Crystals; Enzymes; Pyruvates; Enzymology

20000108878 NASA Scientific and Technical Information Facility, Baltimore-Washington International Airport, MD USA

Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 505

October 2000; 55p; In English

Report No.(s): NASA/SP-2000-7011/SUPPL505; NAS 1.21:7011/SUPPL505; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.

Derived from text

Aerospace Medicine; Data Bases; Bibliographies; Indexes (Documentation)

20000108922 NASA Johnson Space Center, Houston, TX USA

Toxicological Risks During Human Space Exploration

James, John T., NASA Johnson Space Center, USA; Limero, T. F., NASA Johnson Space Center, USA; Lam, C. W., Wyle Labs., Inc., USA; [2000]; 1p; In English; 2000 Aerospace Medical Association Annual Meeting, 14-28 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The goal of toxicological risk assessment of human space flight is to identify and quantify significant risks to astronaut health from air pollution inside the vehicle or habitat, and to develop a strategy for control of those risks. The approach to completing a toxicological risk assessment involves data and experience on the frequency and severity of toxicological incidents that have occurred during space flight. Control of these incidents depends on being able to understand their cause from in-flight and ground-based analysis of air samples, crew reports of air quality, and known failures in containment of toxic chemicals. Toxicological risk assessment in exploration missions must be based on an evaluation of the unique toxic hazards presented by the habitat location. For example, lunar and Martian dust must be toxicologically evaluated to determine the appropriate control measures for exploration missions. Experience with near-earth flights has shown that the toxic products from fires present the highest risk to crew health from air pollution. Systems and payload leaks also present a significant hazard. The health risk from toxicity associated with materials offgassing or accumulation of human metabolites is generally well controlled. Early tests of lunar and Martian dust simulants have shown that each possesses the potential to cause fibrosis in the lung in a murine model. Toxicological risks from air pollutants in space habitats originate from many sources. A number of risks have been identified through near-earth operations; however, the evaluation of additional new risks present during exploration missions will be a challenge.

Author

Aerospace Medicine; Astronauts; Risk; Space Habitats; Spacecrews; Toxic Hazards; Toxicity; Spacecraft Environments

20000109130 MacQuarie Univ., Graduate School of the Environment, Sydney, Australia

Advances in Lead Isotopes in the Health Field

Gulson, B. L., MacQuarie Univ., Australia; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Since the pioneering studies of Manton and Rabinowitz and Wetherill in the early '70s, limited use has been made of Pb isotopes in the health field until recent years. Most investigations have focused on source apportionment of Pb in blood, with varying degrees of success depending on the complexity of sources and concentration of Pb in blood. In adult humans, is greater than 90% of the body burden of Pb is stored in the bones. There is concern that times of physiological stress such as pregnancy and lactation during which the bones undergo resorption and accretion, Pb is released and transferred to the fetus at a critical time of the development of the central nervous system. Over the past decade, this hypothesis has been verified in two major studies supported by the U.S. National Institute of Environmental Health Sciences, one on primates in Ottawa and the other in humans in Australia. Only the results of the human study will be given here. Additional information is contained in the original extended abstract.

Author

Bones; Health; Lead Isotopes; Pregnancy

20000109404 Maryland Univ., Dept. of Chemistry and Biochemistry, College Park, MD USA

Quantum Chemical Model for Apatite Mineralization on Silica Bioceramics

Sahai, N., Maryland Univ., USA; Tossell, J. A., Maryland Univ., USA; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Silicon is considered to be an essential trace element for normal bone development. Bioactive silica ceramics are used as prosthetic bone and dental implants because they promote in vivo bio-mineralization of apatite ($\text{Ca}_5(\text{PO}_4)_3\text{OH}$), as well as in vitro mineralization when immersed in simulated body fluid of composition similar to human blood plasma. Apatite formation occurs in stages but earlier studies disagree on the reaction sequence. Additional information is contained in the original extended abstract.

Author

Body Fluids; Bones; Calcium Phosphates; Ceramics; Implantation; Silicon Dioxide

20000109562 Academy of Sciences, State Key Lab. of Environmental Geochemistry, China

Subchronic Toxicity of Rare Earth Elements and Estimated Daily Intake Allowance

Zhang, H., Academy of Sciences, China; Zhu, W. F., Academy of Sciences, China; Feng, J., Academy of Sciences, China; Ninth Annual V. M. Goldschmidt Conference; August 1999; In English; See also 20000108923; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Some important REE toxicological data were obtained previously based on acute- and sub-chronic toxicity experiments on animals, but these results were indirect and suspectable. This paper focuses the bio-effects of REE on populations from two typical REE-high areas in South Jiangxi, China (Region A is a HREE-enriched area and region B is a LREE-enriched area), and also on the estimation of daily REE intake allowance in terms of REE contents and distribution in food chains. Additional information is contained in the original extended abstract.

Author

Food Chain; Rare Earth Elements; Toxicity

20000109636 Institute of Space Medico-Engineering, Beijing, China

Influence of Weightlessness on Water and Electrolytes Balance in Body

Shen, Xian-Yun, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 65-69; In Chinese; Copyright; Avail: Issuing Activity

The balance of water and electrolytes plays an important role in enabling the human body to adapt to spaceflight. This paper introduced the research methods, and changes in water and electrolytes balance during and after space flight. The mechanism and the hazard of the disorder of water and electrolytes caused by weightlessness were discussed.

Author

Gravitational Effects; Weightlessness; Electrolytes; Water Balance

20000109637 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Effects of Acute Mild and Moderate Hypoxia on Human Mood State

Li, Xue-Yi, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Fu, Chuan, China Southwest Airlines, China; Shen, Xiao-Feng, China Southwest Airlines, China; Wu, Yan-Hong, Fourth Military Medical Univ., China; Wang, Tao, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 1-5; In English; Copyright; Avail: Issuing Activity

The objective of this paper is to explore the effects of acute mild and moderate hypoxia on human mood state.

Author

Hypoxia; Emotional Factors; Moods

20000109638 West China Univ. of Medical Sciences, School of Basic Medical Sciences, Chengdu, China

Effect of Total Flavonoids of Hippophae Rhamnoides on Contractile Mechanics and Calcium Transfer in Stretched Myocyte

Wang, Zheng-Rong, West China Univ. of Medical Sciences, China; Wang, Ling, West China Univ. of Medical Sciences, China; Yin, Hua-Hu, West China Univ. of Medical Sciences, China; Yang, Fang-Ju, West China Univ. of Medical Sciences, China; Gao, Yun-Qin, West China Univ. of Medical Sciences, China; Zhang, Zhu-Jun, Sichuan MEDCO Pharmaceutical Co. Ltd., China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 6-9; In English
Contract(s)/Grant(s): NNSF-39570311; Copyright; Avail: Issuing Activity

the objective of this paper is to study the role of total flavonoids of hippophae rhamnoides in improving contactile function of stretched cardiac myocyte.

Author

Heart Function; Failure; Heart Diseases; Myocardium; Contraction

20000109639 Fourth Military Medical Univ., Dept. of Aerospace Biodynamics, Xi'an, China

Effects of Repeated Low Body Negative Pressure (LBNP) Exposures on LBNP Tolerance

Yang, Chang-Bin, Fourth Military Medical Univ., China; Yao, Yong-Jie, Fourth Military Medical Univ., China; Wei, Ying-Bo, Fourth Military Medical Univ., China; Wu, Yan-Hong, Fourth Military Medical Univ., China; Sun, Xi-Qing, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 10-13; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study is to investigate variation of low body negative pressure (LBNP) tolerance and the relationship with change of heart function after repeated LBNP exposures.

Author

Lower Body Negative Pressure; Human Tolerances

20000109668 NASA Johnson Space Center, Houston, TX USA

Simulated Microgravity Reduces TNF-Alpha Activity, Suppresses Glucose Uptake and Enhances Arginine Flux in Pancreatic Islets of Langerhans

Tobin, Brian W., Diabetes Research Lab.; Leeper-Woodford, Sandra K., Mercer Univ., USA; Hashemi, Brian B., National Space Biomedical Research Inst., USA; Smith, Scott M., Nutritional Biochemistry Lab.; Sams, Clarence F., NASA Johnson Space Center, USA; [2000]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The present studies were designed to determine effects of microgravity upon lipopolysaccharide (LPS) stimulated tumor necrosis factor alpha (TNF - alpha) activity and indices of insulin and fuel homeostasis of pancreatic islets of Langerhans. Islets (1726+/-117,150 u IEU) from Wistar Furth rats were treated as: 1) HARV (High Aspect Ratio Vessel cell culture), 2) HARV plus LPS 3) static culture, 4) static culture plus LPS TNF-alpha (L929 cytotoxicity assay) was significantly increased in LPS-induced HARV and static cultures, yet the increase was more pronounced in the static culture group (p less than 0.05). A decrease in insulin concentration was demonstrated in the LPS stimulated HARV culture (p less than 0.05). We observed a greater glucose concentration and increased disappearance of arginine in islets cultured in HARVs. While nitrogenous compound analysis indicated a ubiquitous reliance upon glutamine in all experimental groups, arginine was converted to ornithine at a two-fold greater rate in the islets cultured in the HARV microgravity paradigm (p less than 0.05). These studies demonstrate alterations in LPS induced TNF-alpha production of pancreatic islets of Langerhans, favoring a lesser TNF activity in the HARV paradigm. These alterations in fuel homeostasis may be promulgated by gravity averaged cell culture methods or by three dimensional cell assembly.

Author

Insulin; Microgravity; Pancreas; Diabetes Mellitus; Aerospace Medicine; Bioastronautics; Glucose

20000109673 NASA Johnson Space Center, Houston, TX USA

Three-Dimensional, Transgenic Cell Models to Quantify Space Genotoxic Effects *Final Report*

Gonda, S. R., NASA Johnson Space Center, USA; Sognier, M. A., Universities Space Research Association, USA; Wu, H., Kelsey Seybold, USA; Pingerelli, P. L., Stratagene, USA; Glickman, B. W., Victoria Univ., Canada; [1999]; 1p; In English, 1-5 Jun. 1999, Pasadena, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The space environment contains radiation and chemical agents known to be mutagenic and carcinogenic to humans. Additionally, microgravity is a complicating factor that may modify or synergize induced genotoxic effects. Most in vitro models fail to use human cells (making risk extrapolation to humans more difficult), overlook the dynamic effect of tissue intercellular interactions on genotoxic damage, and lack the sensitivity required to measure low-dose effects. Currently a need exists for a model test system that simulates cellular interactions present in tissue, and can be used to quantify genotoxic damage induced by low levels of radiation and chemicals, and extrapolate assessed risk to humans. A state-of-the-art, three-dimensional, multicellular tissue equivalent cell culture model will be presented. It consists of mammalian cells genetically engineered to contain multiple copies of defined target genes for genotoxic assessment. NASA-designed bioreactors were used to coculture mammalian cells into spheroids. The cells used were human mammary epithelial cells (H184135) and Stratagene's (Austin, Texas) Big Blue(TM) Rat 2 lambda fibroblasts. The fibroblasts were genetically engineered to contain a high-density target gene for mutagenesis (60 copies of lacI/LacZ per cell). Tissue equivalent spheroids were routinely produced by inoculation of 2 to 7 X 10⁵ fibroblasts with Cytodex 3 beads (150 micrometers in diameter). at a 20:1 cell:bead ratio, into 50-ml HARV bioreactors (Synthecon, Inc.). Fibroblasts were cultured for 5 days, an equivalent number of epithelial cells added, and the fibroblast/epithelial cell coculture continued for 21 days. Three-dimensional spheroids with diameters ranging from 400 to 600 micrometers were obtained. Histological and immunohistochemical Characterization revealed i) both cell types present in the spheroids, with fibroblasts located primarily in the center, surrounded by epithelial cells; ii) synthesis of extracellular matrix; and iii), mitotic cells located throughout the spheroids. Spheroidal integrity and cell viability were retained for the 30-day test period after removal of spheroids from the bioreactor. Potential utility of this three-dimensional, transgenic model for genotoxicity was initially assessed by exposure of spheroids to 0-2 Gy neon at dose rates of 0.3 to 1.5 Gy/min (National Institute of Radiological Sciences, Chiba, Japan). Quantification of mutation at the lacI gene revealed a linear dose response for mutation induction. Limited sequencing analysis of mutant clones revealed higher frequencies of deletions and multiple base sequence changes with increasing dose. These results suggest that our three-dimensional, transgenic model is applicable to a wide variety of studies involving the quantification, identification, and characterization of genotoxicity incurred in space and on Earth. This model uniquely allows investigation of the interaction of relevant factors, namely cell-to-cell interactions and the mechanistic interaction of microgravity with radiation insults and DNA repair. Using this three-dimensional model will allow us to obtain dual genotoxic information (i.e., mutation rate plus chromosome aberration data) from the same system so that one endpoint can be used to reference the other, thereby increasing

the fidelity of the data set. Moreover, the tissue-equivalent nature of the three-dimensional model provides high confidence for relevance of risk assessment, i.e., the establishment of quality factors directly applicable to the microgravity environment.

Author

Cells (Biology); Chromosomes; Deoxyribonucleic Acid; Genes; Mutagens; Genetics; Aerospace Environments; Bioastronautics

20000109679 Naval Medical Research Inst., Bethesda, MD USA

Human Decompression Trial With 1.3 ATA Oxygen in Helium, *Jan. 1995-Apr. 1997*

Jun. 1998; 84p; In English

Contract(s)/Grant(s): Proj-M0099

Report No.(s): AD-A381290; NMRI-98-09; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Naval Medical Research Institute (NMRI) was tasked to develop helium-oxygen decompression tables for a proposed closed circuit breathing apparatus which will deliver a constant oxygen partial pressure of 1.3 atmospheres (ATA). It was anticipated that the higher P_{O2}, compared to the currently used 0.7 ATA, would significantly reduce the required decompression times. This report describes the human dive trial that was conducted to explore the effect of the higher P_{O2} in reducing decompression time. A sequential dive trial was designed in which the outcome of dives at each step dictated the selection of a profile for the next test. Excessive Decompression Sickness (DCS) outcome resulted in selection of a safer next profile. Conversely, low DCS outcome resulted in selection of a riskier profile.

DTIC

Decompression Sickness; Breathing Apparatus; Oxygen; Helium; Diving (Underwater)

20000109680 Lehigh Univ., Bethlehem, PA USA

Mammogram Screening by Automated Followup: A Feasibility Study *Annual Report, 15 Jun. 1998-14 Jun. 1999*

Brzakovic, Dragana; Jul. 1999; 19p; In English

Contract(s)/Grant(s): DAMD17-96-1 6128

Report No.(s): AD-A381307; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes part of a study aimed at developing a computer-based aid for mammogram screening that makes a detailed comparison between mammograms of the same patient acquired at different screenings and detects changes indicative of cancer. The focus of the work in the past three years has been on putting two mammograms acquired at different time into correspondence. The essence of the approach is identification of control points in two mammograms; these points are used to put regions in two mammograms into correspondence. The emphasis of the work in the past year has been on improving the procedure for determining control points, i.e., points that are the same in two images. For this purpose we have developed a model based approach to identify regions of interest in two mammograms. The model encompasses breast tissue characteristics, modeling of compression effects and formation of X-ray images. The model is utilized to develop appropriate segmentation operators and the report discusses utilization of the model to detect lobules and ducts. The model can also be utilized for generating synthetic mammograms. Presently, we are evaluating the improvements this approach offers, relative to our original approach, in terms of determining more reliably control points, namely branching points of ducts.

DTIC

Computer Techniques; Mammary Glands; Cancer

20000109684 People's Liberation Army, Dept. of Gastroenterology, China

Effects of Acute Hypobaric Hypoxia on the Distribution of Somatostatin Contents in Lower Gastrointestinal Tract of Rats

Wu, Zhan-Jun, People's Liberation Army, China; Zhong, Xue-Jun, People's Liberation Army, China; Sun, Yan-Ping, People's Liberation Army, China; Xu, Gang, People's Liberation Army, China; Xu, Kui-Gao, People's Liberation Army, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 55-57; In Chinese; Copyright; Avail: Issuing Activity

The objective of this project is to examine the effects of acute hypobaric hypoxia on the distribution of Somatostatin (SS) contents in lower gastrointestinal tract of rats. 36 Wistar male rats were divided into 6 groups. Three were control groups, three were ulcerous groups. Each group contains ground, 5000 m above sea level and 10000 m above sea level. SS contents were determined with radioimmunoassay methods.

Author

Hypobaric Atmospheres; Hypoxia

20000109686 Institute of Space Medico-Engineering, Beijing, China
Hemodynamic Changes of Pulmonary Circulation During HDT: 30 Deg

Zhong, Chong-Fa, Institute of Space Medico-Engineering, China; Lu, Li-li, Institute of Space Medico-Engineering, China; Yang, Jing-Sheng, Institute of Space Medico-Engineering, China; Zhao, Guo-Xuan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 38-41; In Chinese; Copyright; Avail: Issuing Activity

The purpose of this paper is to study the hemodynamic changes of pulmonary circulation during simulated weightlessness. 12 subjects were studied using echocardiography and electrocardiography during head-down tilt (HDT) of -30 deg lasting for 45 min.

Author

Hemodynamic Responses; Pulmonary Circulation; Head Down Tilt; Blood Flow

20000109705 NASA Johnson Space Center, Houston, TX USA

Relationship of Exercise, Age, and Gender on Decompression Sickness and Venous Gas Emboli During 2-Hour Oxygen Prebreathe Prior to Hypobaric Exposure

Conkin, J., Baylor Univ., USA; Gernhardt, M. L., NASA Johnson Space Center, USA; Foster, P. P., Baylor Univ., USA; Pilmanis, A. A., Armstrong Lab., USA; Butler, B. D., Texas Univ., USA; Beltran, E., Texas Univ., USA; Fife, C. E., Texas Univ., USA; Vann, R. D., Duke Univ., USA; Gerth, W. A., Duke Univ., USA; Loftin, K. C., Wyle Labs., Inc., USA; [2000]; 1p; In English, 18-22 Jun. 2000, Stockholm, Sweden; Sponsored by Undersea and Hyperbaric Medical Society; No Copyright; Avail: Issuing Activity; Abstract Only

We evaluated four 2-hour oxygen prebreathe protocols combining adynamia (non-walking) and 4 different amounts of exercise for potential use with extravehicular activity (EVA) on the International Space Station. Phase I: upper and lower body exercises using dual-cycle ergometry (75% VO₂ max for 10 min). Phase II: same ergometry plus 24 min of light exercise that simulated space suit preparations. Phase III: same 24 min of light exercise but no ergometry, and Phase IV: 56 min of light exercise without ergometry. After 80 min on 100% O₂, the subjects breathed 26.5% O₂ - 73.5% N₂ for 30 min at 10.2 psi. All subjects performed a series of upper body exercises from a recumbent position for 4 hrs at 4.3 psi to simulate EVA work. Venous gas emboli (VGE) were monitored every 12 min using precordial Doppler ultrasound. The 39 female and 126 male exposures were analyzed for correlations between decompression sickness (DCS) or VGE, and risk variables. The duration and quantity of exercise during prebreathe inversely relates to DCS and VGE incidence. The type and distribution of the 19 cases of DCS were similar to historical cases. There was no correlation of age, gender, body mass index, or fitness level with greater incidence of DCS or all VGE. However there were more Grade IV VGE in males is greater than 40 years (10 of 19) than in those is less than 40 years (3 of 107), with *p* less than 0.01 from Fisher's Exact Chi square. The latency time for VGE was longer (103 min +/- 56 SD, *n* = 15 versus 53 min +/- 31, *n* = 13) when the ergometry occurred about 15 min into the prebreathe than when performed at the start of the prebreathe, but the order of the ergometry did not influence the overall DCS and VGE incidence. An increasing amount of exercise during prebreathes reduced the risk of DCS during subsequent exposures to 4.3 psi. Age, gender, or fitness level did not correlate with the incidence of DCS or VGE (combination of Grades I-IV). However males greater than 40 years had a higher incidence of Grade IV VGE.

Author

Aeroembolism; Decompression Sickness; Physical Exercise; Respiration; Astronaut Performance; Aerospace Medicine

20000109720 Institute of Space Medico-Engineering, Beijing, China
A Fluctuographic Analyzing of EEG in Patients with Paroxysmal Headache

Zhuo, Chuan-Dai, Institute of Space Medico-Engineering, China; Han, Dong-Xu, Institute of Space Medico-Engineering, China; Liu, Yue-Hong, Institute of Space Medico-Engineering, China; Zhai, Yi-Juan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 25-28; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study is to offer reference of the screening procedure for aircrew and astronaut selection.

Author

Headache; Flight Crews; Astronauts; Personnel Selection

20000109721 Xian Jiaotong Univ., Biomedical Engineering Inst., China
Exercise ECG Test as a Method for Non-Invasive Detection of Myocardial Ischemia

Ye, Ji-Lun, Xian Jiaotong Univ., China; Zheng, Chong-Xun, Xian Jiaotong Univ., China; Wang, Lei, Xian Jiaotong Univ., China; Tang, Shi-Jun, Xian Jiaotong Univ., China; Huang, Yan, Xian Jiaotong Univ., China; Space Medicine and Medical Engineering;

Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 29-33; In Chinese; Copyright; Avail: Issuing Activity

The objective of this paper is to improve the exercise ECG analysis for non-invasively detection of myocardial ischemia.

Author

Human Centrifuges; Medical Services; Myocardium; Ischemia

20000109722 Institute of Aviation Medicine, Beijing, China

Effects of Rotating-Table Simulated "Push-Pull Maneuver" on Cerebral Circulation Function

Zhang, Wu-Xing, Institute of Aviation Medicine, China; Zhan, Chang-Lu, Institute of Aviation Medicine, China; Geng, Xi-Chen, Institute of Aviation Medicine, China; Yan, Gui-Ding, Institute of Aviation Medicine, China; Lu, Xia, Institute of Aviation Medicine, China; Chu, Xu, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 34-37; In Chinese; Copyright; Avail: Issuing Activity

The objective of this study is to investigate the change and regulation of cerebral circulation during rotating-table simulated push-pull maneuver.

Author

Cerebrum; Brain Circulation; Blood Flow; Flow Velocity

20000109725 Naval General Hospital, Beijing, China

Effects of Heat and Noise Environments on Lipid Peroxidation Erythrocyte Membrane in Pilots

Hao, Wei-Wei, Naval General Hospital, China; Qin, Shi-Zhen, Naval General Hospital, China; Yu, Qi-Fu, Naval General Hospital, China; Li, Ming-Gao, Naval General Hospital, China; Ma, Gui-Xi, Naval General Hospital, China; Zhao, Hong, Naval General Hospital, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 52-54; In Chinese; Copyright; Avail: Issuing Activity

The purpose of this paper is to investigate the effects of heat and noise environments on lipid peroxidation of erythrocyte membrane in pilots. Twenty-four pilots and twenty-one ground personnel (control group) served as the subjects. The pilots performed flying in heat and noise environments. Glutathione peroxidase (GSHpx) and malondialdehyde (MDA) levels in erythrocyte membrane were determined before flying (6:00 a.m.), immediately after flying (12:00 a.m.) and 8 hours after flying (8:00 p.m.) respectively with a spectrophotometer.

Author

Noise (Sound); Temperature Effects; High Temperature Environments; Lipids; Glutathione; Erythrocytes; Cell Membranes (Biology)

20000109726 Air Force General Hospital, Beijing, China

Sensorineural Deafness and Aerospace Flight

Xu, Xian-Rong, Air Force General Hospital, China; Liu, Hua-Feng, Air Force General Hospital, China; Guo, Li-Ying, Air Force General Hospital, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 58-60; In Chinese; Copyright; Avail: Issuing Activity

The objective of this paper is to probe the relations between sensorineural deafness and flying in aviation or space. Case studies of sensorineural deafness were made in 36 pilots.

Author

Auditory Defects; Space Flight

20000109727 Institute of Space Medico-Engineering, Beijing, China

Measurement and Evaluation of Visual Index in VDT Operators Under Multi-User System

Liao, Guo-Feng, Institute of Space Medico-Engineering, China; Zhong, Hao, Institute of Space Medico-Engineering, China; Jiang, Guo-Hua, Institute of Space Medico-Engineering, China; Mu, Xiao-Fei, Institute of Space Medico-Engineering, China; Wu, Wen-Can, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 61-64; In Chinese; Copyright; Avail: Issuing Activity

The main objective of this paper is to evaluate the visual function of the visual display terminal (VDT) operators under the Multi-user system. Subjective symptoms of the VDT operators under the Multi-user system were measured before and after work in the field study. Visual indices were measured at 8:15, 9:15, 10:15, 11:15, or 12:15 a.m.

Author

Display Devices; Visual Aids; Audio Visual Equipment; Visual Acuity

20000109729 Institute of Space Medico-Engineering, Beijing, China

Weightlessness and Heat Stress on Astronauts

Yu, Xue-Jun, Institute of Space Medico-Engineering, China; Yang, Tian-De, Institute of Space Medico-Engineering, China; Pang, Cheng, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 70-73; In English; Copyright; Avail: Issuing Activity

Thermal emergency situations have more than once been encountered since the beginning of manned space flights in 1961. This article contemplates human thermal tolerance in weightlessness as complicated with headward fluid shifts, plasma volume loss, cardiovascular deconditioning, reduced exercise capacity and energy metabolism changes, etc. With these considerations, it is necessary to further investigate the thermoregulation in spaceflight for the health and safety of astronauts.

Author

Weightlessness; Heat Tolerance; Human Tolerances; High Temperature Environments; Astronauts

20000109730 Institute of Space Medico-Engineering, Beijing, China

CAT System and Its Application in Training for Manned Space Flight

Zhu, Ziu-Qing, Institute of Space Medico-Engineering, China; Chen, Dao-Mu, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Feb. 2000; ISSN 1002-0837; Volume 13, No. 1, pp. 74-78; In Chinese; Copyright; Avail: Issuing Activity

As aerospace missions get increasingly frequent and complex, training becomes ever more critical. Training devices in all levels are demanded. Computer-Aided Training (CAT) system, because its economic, efficient and flexible, is attracting more and more attention. In this paper, the basic factors of CAT system were discussed; the applications of CAT system in training for manned space flight were illustrated. Then we prospected further developments of CAT system.

Author

Computer Assisted Instruction; Training Simulators; Training Devices; Flight Simulators

20000109798 Brigham and Women's Hospital, Boston, MA USA

FACTS (Find the Appropriate Clinical Trials) for You: A Computer-Based Decision Support System for Breast Cancer Patients *Annual Report, 20 Apr. 1998-19 Apr. 1999*

Ohno-Machado, Lucila; May 1999; 82p; In English

Contract(s)/Grant(s): DAMD17-98-1-8039

Report No.(s): AD-A381179; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

We have developed a system for clinical trial eligibility determination where patients or primary care providers can enter clinical information about a patient and obtain a ranked list of clinical trials for which the patient is likely to be eligible. We used clinical trial eligibility information from the National Cancer Institute's Physician Data Query (PDQ) database. We translated each free-text eligibility criterion into a machine executable statement using a derivation of the Arden Syntax. Clinical trial protocols were then structured as collections of these eligibility criteria using XML. The application compares the entered patient information against each of the eligibility criteria and returns a numerical score. Results are displayed in order of likelihood of match. We have tested our system using all phase II and III clinical trials for treatment of metastatic breast cancer found in the PDQ database. Preliminary results are encouraging. We have completed the tasks in the approved statement of work that were planned for Year I of this project. A working prototype of the system we envision as our final product is available at <http://telmato.bwh.harvard.edu:8000/FACTS/FormIn.htm>.

DTIC

Computer Techniques; Decision Support Systems; Patients; Cancer; Clinical Medicine

20000109799 Louisiana State Univ., Baton Rouge, LA USA

Determination of Total Daily Energy Requirements and Activity Patterns of Service Women *Annual Report, 26 Sep. 1998-25 Sep. 1999*

Delaney, James P.; Oct. 1999; 27p; In English

Contract(s)/Grant(s): DAMD17-96-2-6025

Report No.(s): AD-A381203; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of the current study is to define a range of energy requirements of servicewomen, defining the variation as it relates to jobs, military settings, and activity patterns. This is crucial information needed not only for determination of nutritional requirements for energy balance, but specific nutrient density standards for servicewomen. Total daily energy expenditure is measured using the doubly labeled water (DLW) method. Activity patterns from actigraphs will be analyzed for hours of sleep, description of job/work patterns by examining bursts of concerted activity versus steady activity. Energy requirements for men

have been better established and will serve to anchor the results obtained in women to previously established norms in men. The first field study was conducted at Fort Bragg/Camp Mckall during a Combat Support Hospital training exercise. Energy expenditures were moderate, and higher in men than women. However, when adjusting for differences in body size, energy expenditures were similar. Very high energy expenditures were observed during the Crucible studies in Marine Recruits. Further data analyses for this study are being carried out. Planning for the next studies are underway. The Shipboard study is planned to occur in November or December of 1999. The Marine Basic Training Study planning is underway and should occur early in 2000.
DTIC

Energy Consumption; Physical Exercise; Nutritional Requirements; Energy Requirements; Females; Nutrients

20000109857 NASA Marshall Space Flight Center, Huntsville, AL USA

Overexpression of Human Bone Alkaline Phosphatase in *Pichia Pastoris*

Karr, Laurel, NASA Marshall Space Flight Center, USA; Malone, Christine, C., Universities Space Research Association, USA; [2000]; 1p; In English; 2000 Current Topics in Gene Expression Systems Conference, 25 Sep. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The *Pichiapastoris* expression system was utilized to produce functionally active human bone alkaline phosphatase in gram quantities. Bone alkaline phosphatase is a key enzyme in bone formation and biomineralization, yet important questions about its structural chemistry and interactions with other cellular enzymes in mineralizing tissues remain unanswered. A soluble form of human bone alkaline phosphatase was constructed by deletion of the 25 amino acid hydrophobic C-terminal region of the encoding cDNA and inserted into the X-33 *Pichiapastoris* strain. An overexpression system was developed in shake flasks and converted to large-scale fermentation. Alkaline phosphatase was secreted into the medium to a level of 32mgAL when cultured in shake flasks. Enzyme activity was 12U/mg measured by a spectrophotometric assay. Fermentation yielded 880mgAL with enzymatic activity of 968U/mg. Gel electrophoresis analysis indicates that greater than 50% of the total protein in the fermentation is alkaline phosphatase. A purification scheme has been developed using ammonium sulfate precipitation followed by hydrophobic interaction chromatography. We are currently screening crystallization conditions of the purified recombinant protein for subsequent X-ray diffraction analyses. Structural data should provide additional information on the role of alkaline phosphatase in normal bone mineralization and in certain bone mineralization anomalies.

Author

Bones; Calcification; Bone Demineralization; Physiological Effects; Human Body

20000109863 Utah Univ., Dept. of Radiation Oncology, Salt Lake City, UT USA

Radioprotection of Human Cell Nuclear DNA by Polyamines: Radiosensitivity of Chromatin is Influenced by Tightly Bound Spermine

Warters, Raymond L., Utah Univ., USA; Newton, Gerald L., California Univ., San Diego, USA; Olive, Peggy L., British Columbia Univ., Canada; Fahey, Robert C., California Univ., San Diego, USA; Radiation Research; 1999; ISSN 0033-7587; Volume 151, pp. 354-362; In English

Contract(s)/Grant(s): NAGW-4914; NIH-NCI-CA-35982; NIH-5P30-CA-42014; Copyright; Avail: Issuing Activity

The polyamines putrescine (PUT) and spermine (SPM) were examined for their ability to protect human cell Deoxyribonucleic Acid (DNA) against the formation of radiation-induced double-strand breaks (DSBs). As observed previously, under conditions where polyamines were shown to be almost completely absent, association with nuclear matrix protein into a nucleoid, and organization into chromatin structure, protected DNA from induction of DSBs by factors of 4.5 and 95, respectively. At concentrations below 1 mM, PUT or SPM provided equivalent levels of protection to deproteinized nuclear DNA, consistent with their capacity to scavenge radiation-induced radicals. At constant ionic strength, 5 mM SPM protected deproteinized DNA and nucleoid DNA and DNA in nuclear chromatin by factors of 100 and 26, respectively. At 5 mM, SPM provided 15 times greater protection of deproteinized DNA than did PUT. Under physiologically relevant conditions, 5 mM SPM protected DNA in the intact nucleus from the induction of DSBs by a factor of 2 relative to DNA in the absence of SPM. Studies of SPM binding during cellular fractionation revealed that a significant fraction of the cellular SPM is tightly bound in the nucleus but can be removed by extended washing. Thus the association of SPM with nuclear chromatin appears to be a significant contributor to the resistance of the cell's DNA to the induction of DSBs.

Author

Radiation Protection; Cells (Biology); Human Beings; Deoxyribonucleic Acid

20000109879 NASA Johnson Space Center, Houston, TX USA

Cell-Mediated Immune Function and Cytokine Regulation During Space Flight

Sams, Clarence F., NASA Johnson Space Center, USA; Pierson, Duane L., NASA Johnson Space Center, USA; [2000]; 1p; In

English; No Copyright; Avail: Issuing Activity; Abstract Only

The changes in immune function which occur during space flight potentially expose the crews to an increased risk for development of illness. Decreased cellular immune function has been repeatedly documented after space flight and confirmed during flight by in vivo delayed-type hypersensitivity testing. However, correlation of immune changes with a clinically significant risk factor has not yet been performed. Our hypothesis is that space flight induces a decrease in cell-mediated immune function accompanied by a shift from a type 1 cytokine pattern (favoring cell-mediated immunity) to a type 2 cytokine pattern (favoring humoral immunity). We further hypothesize that reactivation of latent viruses will occur during space flight in association with the decreased cellular immunity. To test these hypotheses, we will determine the effects of space flight on cell-mediated immunity and viral reactivation. We will utilize delayed-type hypersensitivity testing as an in vivo measure of integrated cell-mediated immune function. The production of cytokines and immunoregulatory factors by lymphocytes and monocytes will be measured to determine whether changes in cytokine patterns are associated with the space flight-induced immune dysregulation. Correlation of antigen-specific immune changes with reactivation of latent herpes viruses will be determined by measuring peripheral levels of viral (CMV, VZV, EBV) antigen-specific T cells and comparing to the levels of EBV-infected B-cells by fluorescence in situ hybridization and flow cytometry. A comparison of cell-mediated immune function, cytokine regulation and viral reactivation will provide new insights into crew member health risks during flight.

Author

Immune Systems; Antigens; Lymphocytes; Space Flight

20000109899 Kyushu Univ., Faculty of Engineering, Fukuoka, Japan

Entrainment of Brain Wave as a Complex System

Mori, Toshio, Kyushu Univ., Japan; Kimura, Takeshi, Kyushu Univ., Japan; Yamazaki, Hideki, Kyushu Univ., Japan; Technology Reports of Kyushu University; September 2000; ISSN 0023-2718; Volume 73, No. 5, pp. 577-584; In Japanese; Copyright; Avail: Issuing Activity

The alpha rhythm is a very stable brain wave compared with the other rhythms (beta, theta, delta), and its spatio-temporal aspect is rich in variety. The alpha rhythm for example usually shows very chaotic behavior. From viewpoints of the complex system, in the present study, we focus our subjects on the entrainment of the alpha rhythm by photic stimulation to investigate its nonlinear dynamics. The entrainment is obtained only at neighboring frequencies to one of the alpha rhythm. We propose a new idea for the mechanism of the alpha rhythm based on the experimental results and discuss about the analogy with the nonlinear dynamics observed in the Belousov-Zhabotinsky reaction.

Author

Brain Circulation; Rhythm (Biology); Stability; Electroencephalography

20000109956 NASA Ames Research Center, Moffett Field, CA USA

Development of Wireless Subsurface Microsensors for Health Monitoring of Thermal Protection Systems

Pallix, Joan, NASA Ames Research Center, USA; Milos, Frank, NASA Ames Research Center, USA; [2000]; 1p; In English; Research Symposium of the Spring Conference, 27 Mar. 2000, Birmingham, AL, USA; Sponsored by American Society for Nondestructive Testing, Inc., USA

Contract(s)/Grant(s): RTOP 242-82-85; No Copyright; Avail: Issuing Activity; Abstract Only

Low cost access to space is a primary goal for both NASA and the U.S. aerospace industry. Integrated subsystem health diagnostics is an area where major improvements have been identified for potential implementation into the design of new reusable launch vehicles (RLVS) in order to reduce life cycle costs, increase safety margins and improve mission reliability. A number of efforts are underway to use existing and emerging technologies to establish new methods for vehicle health monitoring on operational vehicles as well as X-vehicles. This paper summarizes a joint effort between several NASA centers and industry partners to develop rapid wireless diagnostic tools for failure management and long-term TPS performance monitoring of thermal protection systems (TPS) on future RLVS. An embedded wireless microsensor suite is being designed to allow rapid subsurface TPS health monitoring and damage assessment. This sensor suite will consist of both passive overlimit sensors and sensors for continuous parameter monitoring in flight. The on-board diagnostic system can be used to radio in maintenance requirements before landing and the data could also be used to assist in design validation for X-vehicles. For a 3rd generation vehicle, wireless diagnostics should be at a stage of technical development that will allow use for intelligent feedback systems for guidance and navigation control applications and can also serve as feedback for TPS that can intelligently adapt to its environment.

Author

Microelectronics; Thermal Protection; Aerospace Industry; Systems Integration; Wireless Communication

20000109958 NASA Ames Research Center, Moffett Field, CA USA

Low LBNP Tolerance in Men is Associated With Attenuated Activation of Renin-Angiotensin System

Greenleaf, John E., NASA Ames Research Center, USA; Petersen, T. W., Danish Aerospace Medical Center of Research, Denmark; Gabrielsen, A., Danish Aerospace Medical Center of Research, Denmark; Pump, B., Danish Aerospace Medical Center of Research, Denmark; Bie, P., Danish Aerospace Medical Center of Research, Denmark; Christensen, N.-J., Danish Aerospace Medical Center of Research, Denmark; Warberg, J., Danish Aerospace Medical Center of Research, Denmark; Videbaeck, R., Danish Aerospace Medical Center of Research, Denmark; Simonson, S. R., Danish Aerospace Medical Center of Research, Denmark; Norsk, P., Danish Aerospace Medical Center of Research, Denmark; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Vasoactive hormone concentrations (epinephrine (pE), norepinephrine (pNE), angiotensin II (pATII), vasopressin (pVP), endothelin 1 (pET1)) and plasma renin activity (pRA) were measured during lower body negative pressure (LBNP) to test the hypothesis that responsiveness of the renin-angiotensin system is related to LBNP tolerance. Healthy men (2,822 cal per day, 2 mmol per kilogram per day Na (+)) were exposed to 30 min of progressive LBNP to -50mmHg. LBNP was uneventful for 7 men (2512 yr, HiTol group), but 8 men (26 plus or minus 3 yr) reached pre-syncope after 11 plus or minus 1 min (P less than 0.001, LoTol group). Mean arterial pressure was unchanged. Central venous pressure and left atrial diameter decreased in both groups (5-6 mmHg by 30%, P less than 0.05). Control [hormone] were similar but, pRA differed between groups (LoTol 0.6 plus or minus 0.1, HiTol 1.2 plus or minus 0.1 ng Ang I per milliliter per hour, per hour, P less than 0.05). LBNP increased (P less than 0.05) pRA and pATII more in HiTol (9.9 plus or minus 2.2 ng Ang I per milliliter per hour and 58 plus or minus 12 pg per milliliter) than LoTol (4.3 plus or minus 0.9 ng Ang I per milliliter per hour and 28 plus or minus 6 pg per milliliter). In contrast, pVP was higher (P less than 0.05) in LoTol than in HiTol. The response of the renin-angiotensin system seems linked to the occurrence of pre-syncope, and measurement of resting pRA may be predictive.

Author

Hormones; Lower Body Negative Pressure; Males; Vasoconstrictor Drugs; Antidiuretics; Immunoassay

20000109963 NASA Ames Research Center, Moffett Field, CA USA

Differences in Acceleration Training and Exercise Training on Resting Cardiovascular Variables

Evans, J. M., NASA Ames Research Center, USA; Simonson, S. R.; Knapp, C. F.; Stocks, J. M.; Biagini, H. W.; Cowell, S. A.; Bailey, Kn. N.; Vener, J. M.; Evetts, S. N.; [2000]; 1p; In English

Contract(s)/Grant(s): RTOP UPN-111-10-20; No Copyright; Avail: Issuing Activity; Abstract Only

The relative effects of alternating exercise vs. acclimation training on mean blood pressure (BP, Finapres), cardiac output (CO, BoMed) and peripheral resistance (PR, calculated) were evaluated. Six healthy men (33 \pm 6 yr, 178 \pm 4 cm, 86 \pm 6 kg) underwent exercise training (ET, n=3): supine on a cycle ergometer (40 to 90% Vo₂ max) during exposure to constant +1 G_z for 30 min/day for 14 days on NASA's 1.9m Human Powered Centrifuge (HPC). They also underwent oscillatory (between +1 G_z and 2.5 G_z) acceleration training (AT, n=3) for 30 min/day for 14 days on the HPC. After four weeks of ambulatory deconditioning, training protocols were switched. AT increased resting CO by 9.1 \pm 3.2% (p less than 0.05) with no effect on BF, and ET decreased BP by 9.2 \pm 4.6% (p less than 0.08) as well as spectral power of PR by 41 \pm 9% (p less than 0.05). The major effect of acceleration training was to increase resting cardiac output while that of exercise training was to decrease resting blood pressure.

Author

Cardiovascular System; Physical Exercise; Aerospace Medicine; Acceleration Stresses (Physiology)

20000110018 NASA Johnson Space Center, Houston, TX USA

Marked Exacerbation of Orthostatic Intolerance After Long vs. Short-Duration Spaceflight in Veteran Astronauts

Fritsch-Yelle, Janice M., NASA Johnson Space Center, USA; Reyes, Carlos, Wyle Labs., Inc., USA; Perez, Sondra A., Wyle Labs., Inc., USA; Goldberger, Ary L., Beth Israel Deaconess Medical Center, USA; Ziegler, Michael G., California Univ., USA; December 1999; 2p; In English

Contract(s)/Grant(s): NAS9-97005; NAG5-6350; No Copyright; Avail: Issuing Activity; Abstract Only

The incidence of postflight orthostatic intolerance following short-duration spaceflight is about 20%. However, the incidence following long-duration spaceflight is unknown. We performed tilt tests on six astronauts before and after their long-duration (129 - 190 days) spaceflights and compared these data to those obtained during stand tests before and after their previous short-duration missions and also to tilt test data from 20 different short-duration (8 - 16 days) flight astronauts. Five of these six became presyncopal during tilt testing after long-duration flights: only one had become presyncopal during stand testing after short-duration flights. Five of the twenty astronauts who flew on other short-duration flights, became presyncopal during upright tilt on landing day. Long-duration presyncopal subjects had lower stroke volumes, lower cardiac outputs and higher peripheral

vascular resistance than short-duration presyncopal subjects, but their heart rate responses were not different. One subject had subnormal norepinephrine release with upright posture after a long but not short flight. Plasma volume losses were not greater after long flights. Long-duration spaceflight markedly increases orthostatic intolerance, probably related to altered autonomic function.

Author

Long Duration Space Flight; Autonomic Nervous System; Astronauts; Cardiovascular System; Aerospace Medicine; Head Up Tilt

20000110067 NASA Johnson Space Center, Houston, TX USA

Space Flight Decompression Sickness Contingency Plan

Dervay, Joseph, NASA Johnson Space Center, USA; Gernhardt, Michael L., NASA Johnson Space Center, USA; Ross, Charles E., NASA Johnson Space Center, USA; Hamilton, Douglas, Wyle Labs., Inc., USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The purpose was to develop an enhanced plan to diagnose, treat, and manage decompression sickness (DCS) during extravehicular activity (EVA). This plan is merited by the high frequency of upcoming EVAs necessary to construct and maintain the International Space Station (ISS). The upcoming ISS era will demand a significant increase in EVA. The DCS Risk and Contingency Plan provided a new and improved approach to DCS reporting, treatment, management, and training.

Derived from text

Space Flight; Decompression Sickness

20000110070 NASA Johnson Space Center, Houston, TX USA

Human Trials of a 2-Hour Prebreathe Protocol

Butler, Bruce D., Texas Univ. Medical School, USA; Vann, R. D., Duke Univ., USA; Nishi, Ronald Y., Defence and Civil Inst. of Environmental Medicine, Canada; Gerth, W. A., Duke Univ., USA; Beltran, E., Texas Univ. Medical School, USA; Conkin, J., Baylor Coll. of Medicine, USA; Schneider, Suzanne, NASA Johnson Space Center, USA; Loftin, K. C., Wyle Labs., Inc., USA; Sullivan, Pat A., Canadian Space Agency, Canada; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

We evaluate 2-hour prebreathe protocols combining simulated microgravity and exercise during prebreathe with the objective of validating a protocol for use on International Space Station (ISS). The protocol was tested with four different exercise doses during prebreathe in a multi-center trial involving three laboratories. Subject selection, Doppler monitoring techniques for venous gas emboli (VGE), test termination criteria, and definitions of decompression sickness (DCS) were standardized in all laboratories. The Phase II protocol met the accept criteria for a prebreathe procedure for use by astronauts during assembly and maintenance of the ISS Dual-cycle ergometry or light exercise individually was not sufficient to protect against DCS at acceptable levels. The combination of both was successful.

Derived from text

High Altitude Breathing; Microgravity; Physical Exercise

20000110138 NASA Johnson Space Center, Houston, TX USA

Assessment of Countermeasure Efficacy for Long-Term Space Missions

Feiveson, Alan H., NASA Johnson Space Center, USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

One of the main functions of the upcoming International Space Station (ISS) will be to provide a venue for testing proposed countermeasures for their ability to protect humans from the debilitating effects of longterm space flight. However, several limiting factors preclude an evaluation process similar to that used in clinical trials which traditionally are implemented with large sample sizes of subjects, including control groups, and with blind or double-blind application of treatments according to factorial or other balanced experimental designs. In particular, only very limited numbers of human subjects will be available for actual field testing in the ISS. With no more than 125 subjects planned to fly on all ISS missions over 10 years, it is not possible to test extensive combinations of some 15-20 proposed countermeasures. Furthermore because of safety concerns and operational considerations, it is unlikely that anything other than the current best guess at the most effective countermeasure package will ever be used on ISS. In particular, control or placebos will not be allowed. In view of these limitations, historical data and groundbased or animal studies will have to be used to compensate for small sample sizes and lack of controls in the field. As a result, statistical analysis methodology will have to be developed which allows for the integration of these disparate data types into a meaningful evaluation process. The process must be sequential, providing objective rules for deciding through time whether to reject or modify an ineffective

countermeasure, or whether to certify one as effective. Additional output should include performance characteristics for all relevant physiological systems, including uncertainty analyses and estimates of accept/reject decision error rates.

Author

Assessments; Countermeasures; Long Duration Space Flight; Flight Stress (Biology); Biological Effects; Human Beings

20000110943 Arizona Univ., Dept. of Radiation Oncology, Tucson, AZ USA

Free Radicals Generated by Ionizing Radiation Signal Nuclear Translocation of p53

Martinez, J. D., Arizona Univ., USA; Pennington, M. E., Arizona Univ., USA; Craven, M. T., Arizona Univ., USA; Warters, R. L., Utah Univ., USA; September 1997; Volume 8, pp. 941-949; In English

Contract(s)/Grant(s): DOE-307190; NAGW-4914; NIH-R29-CA-64842; NIH-R29-CA-23074; HHMI-71109-52130; Copyright; Avail: Issuing Activity

The p53 tumor suppressor is a transcription factor that regulates several pathways, which function collectively to maintain the integrity of the genome. Nuclear localization is critical for wild-type function. However, the signals that regulate subcellular localization of p53 have not been identified. Here, we examine the effect of ionizing radiation on the subcellular localization of p53 in two cell lines in which p53 is normally sequestered in the cytoplasm and found that ionizing radiation caused a biphasic translocation response. p53 entered the nucleus 1-2 hours postirradiation (early response), subsequently emerged from the nucleus, and then again entered the nucleus 12-24 hours after the cells had been irradiated (delayed response). These changes in subcellular localization could be completely blocked by the free radical scavenger, WR1065. By comparison, two DNA-damaging agents that do not generate free radicals, mitomycin C and doxorubicin, caused translocation only after 12-24 h of exposure to the drugs, and this effect could not be inhibited by WR1065. Hence, although all three DNA-damaging agents induced relocation of p53 to the nucleus, only the translocation caused by radiation was sensitive to free radical scavenging. We suggest that the free radicals generated by ionizing radiation can signal p53 translocation to the nucleus.

Author

Ionizing Radiation; Tumors; Irradiation; Radiation Effects

20000111088 Wyle Labs., Inc., Medical Operations Branch, Houston, TX USA

Medical Training Issues and Skill Mix for Exploration Missions

Janney, R. P., Wyle Labs., Inc., USA; Armstrong, C. W., Wyle Labs., Inc., USA; Stepaniak, P. C., Wyle Labs., Inc., USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The approach for treating in-flight medical events during exploration-class missions must reflect the need for an autonomous crew, and cannot be compared to current space flight therapeutic protocols. An exploration mission exposes the crew to periods of galactic cosmic radiation, isolation, confinement, and microgravity deconditioning far exceeding the low-Earth orbital missions performed to date. In addition, exploration crews will not be able to return to Earth at the onset of a medical event and will need to control the situation in-flight. Medical consultations with Earth-based physicians will be delayed as much as 40 minutes, dictating the need for a highly-trained medical team on board. This presentation will address the mix of crew medical skills and the training required for crew health care providers for missions beyond low-Earth orbit. Both low- and high-risk options for medical skill mix and preflight training will be compared.

Author

Medical Personnel; Aerospace Medicine; Telemedicine; Space Exploration

20000112959 NASA Ames Research Center, Moffett Field, CA USA

EEG Analysis of the Effects of Therapeutic Cooling on the Cognitive Performance of Multiple Sclerosis Patients

Montgomery, Leslie D., Lockheed Martin Engineering and Sciences Co., USA; Montgomery, Richard W., Lockheed Martin Engineering and Sciences Co., USA; Ku, Yu-Tsuan E., Lockheed Martin Engineering and Sciences Co., USA; Luna, Bernadette, NASA Ames Research Center, USA; Lee, Hank C., Lockheed Martin Engineering and Sciences Co., USA; Kliss, Mark, NASA Ames Research Center, USA; Webbon, Bruce, NASA Ames Research Center, USA; [1999]; 30p; In English

Contract(s)/Grant(s): RTOP 251-10-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The objective of this project was to determine whether a controlled period of head and torso cooling would enhance the cognitive performance of multiple sclerosis patients. Nineteen MS patients (11 men and 8 women) participated in the study. Control data were taken from nineteen healthy volunteers (12 men and 7 women). All but six of nineteen MS patients tested improved their cognitive performance, as measured by their scores on the Rao test battery. A second objective was to gain insight into the neurological effects of cooling. Visual evoked potentials (VEPs) stimulated by a reversing checkerboard pattern were recorded before and after cooling. We found that cooling selectively benefited the cognitive performance of those MS patients

whose pre-cooling VEPs were abnormally shaped (which is an indication of visual pathway impairment due to demyelination). Moreover, for female MS patients, the degree of cognitive performance improvement following cooling was correlated with a change in the shape of their VEPs toward a more normal shape following cooling.

Author

Bioelectric Potential; Cooling; Mental Performance; Neurology; Therapy; Clinical Medicine; Cognitive Psychology; Electroencephalography

20000113831 University of Southern California, Los Angeles, CA USA

An Innovative Assessment of Endogenous Estrogen Activity in Persons with Different Habits of Exercise Annual Report, 1 Sep. 1998-30 Aug. 1999

Hamilton, Ann S.; Sep. 1999; 19p; In English

Contract(s)/Grant(s): DAMD17-97-1-7081

Report No.(s): AD-A380910; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Evidence exists that women exercising have lower estrogen levels than sedentary women. These lower estrogen levels may be the mechanism behind their reduced breast cancer risk. Previous studies included athletes with high exercise levels, and estrogen measurements were based on a few serum samples from different times during a menstrual cycle. This study includes identical female twins who are discordant for moderate exercise. Estradiol is measured on a daily basis from saliva samples collected during a complete menstrual cycle. Procedures and questionnaires have been developed; enrollment of eligible pairs is ongoing. Screening interviews have been conducted with 197 pairs. of these, 36 were initially eligible; however 7 declined to participate and 2 later became ineligible due to menopausal related reasons. Thus, sample collection is currently completed or underway for 27 pairs. Estradiol and progesterone assays have been completed for 16 pairs. Although fewer eligible pairs were identified than expected, more twins will be available from additional phases of the California Twin Program. In Year 3, we will continue to screen and enroll twins, complete data entry of questionnaires, conduct hormonal assays, integrate laboratory and questionnaire data sets, and complete preliminary analyses. It is anticipated that a 1 year no cost extension will be requested.

DTIC

Physical Exercise; Estrogens; Mammary Glands; Cancer

20000113922 Ohio State Univ., Research Foundation, Columbus, OH USA

X-Photon-to-Information Conversion Efficiency in Digital Telemammography Annual Report, 1 Jun 1998-31 May 1999

Williams, Celeste B.; Clymer, Bradley D.; Jun. 1999; 31p; In English

Contract(s)/Grant(s): DAMD17-96-1-6139

Report No.(s): AD-A374996; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Imaging techniques for diagnosis and detection of breast cancer deform the breast from its original shape by applying external forces. However, these methods do not take into account the mechanical nature of breast tissue. It is known that pathology has different elastic properties than healthy tissue and the characterization of the mechanical nature of tissue may act as a diagnostic tool, which may improve the prognosis for breast cancer patients. This research is based on these factors of breast cancer research. The purpose of this study is to non-invasively estimate the in vivo force-deformation behavior of normal breast tissue undergoing mild compression.

DTIC

Mammary Glands; Cancer; Diagnosis; Tissues (Biology); Imaging Techniques; Digital Techniques; Deformation; Prognosis

20000114275 Fourth Military Medical Univ., Dept. of Aerospace Medicine, Xi'an, China

Effects of Acute Exposure to Mild or Moderate Hypoxia on Human Psychomotor and Visual-Reaction Time

Li, Xue-Yi, Fourth Military Medical Univ., China; Wu, Xing-Yu, Fourth Military Medical Univ., China; Fu, Chuan, China Southwest Airlines, China; Shen, Xiao-Feng, China Southwest Airlines, China; Yang, Chang-Bin, Fourth Military Medical Univ., China; Wu, Yan-Hong, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 235-239; In English; Copyright; Avail: Issuing Activity

The aim of this study was to determine whether psychomotor performance and visual reaction time were affected by acute exposure to mild or moderate hypoxia.

Author

Exposure; Hypoxia; Psychomotor Performance

20000114276 Fourth Military Medical Univ., Dept. of Aerospace Physiology, Xi'an, China

Effects of Sleep Deprivation on Human Performance

Fu, Zhao-Jun, Fourth Military Medical Univ., China; Ma, Rui-Shan, Fourth Military Medical Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 240-243; In Chinese; Copyright; Avail: Issuing Activity

To investigate the effects of sleep deprivation (SD) on human performance. 8 healthy male college students participated the test. During 26 h of continuous awakeness (from 6:00 to 8:00 the next day), the volunteers were demanded to perform a battery of tests at 9 different time (7:00, 12:00, 16:00, 20:00, 0:00, 2:00, 4:00, 6:00, 8:00). The tests include: (1) single task: aural Oddball response, the response time (RT1) and correct rate (CR(sub 1)) were recorded; (2) dual tasks: manual tracking and aural Oddball response, the response time (RT(sub 2)), tracking error (ER) and correct rate (CR2) were recorded; (3) the Stanford sleepiness scale and subjective ratings of task difficulty access. SD had significant effects on CT(sub 1), CT(sub 2) and ER ($P = 0.0001$, $P = 0.00001$, $P = 0.0004$ respectively); SD increased RT(sub 1), RT(sub 2), ER at night time. SD had significant effects on SD increased SR, SSS score at night time. Since the subjects changed their response strategy, CR1 and CR2 were not influenced by SD at night time. SD has significant effects on response time, tracking error subjective difficulty of cognitive tasks and subjective sleepiness.

Author

Circadian Rhythms; Human Performance; Mental Performance; Sleep Deprivation; Time Measurement

20000114278 Xian Jiaotong Univ., Dept. of Biomedical Engineering, China

Effects of Mild and Moderate Hypoxia on Complexity-Measure of the EEG Signals

Huang, Li-Yu, Xian Jiaotong Univ., China; Cheng, Jing-Zhi, Xian Jiaotong Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 255-258; In Chinese; Copyright; Avail: Issuing Activity

Non-linear analysis of EEG signals is important in EEG studies. In this paper, the effects of mild or moderate hypoxia on the complexity of EEG were studied. A model for acute altitude hypoxia experiment was presented. EEG before and 30 minutes during four different levels of hypoxia were recorded. The complexities of these EEG signals were analyzed. With increase of altitude and time, to a certain extent, the complexity became lower than that under normal condition. The complexity of EEG is sensitive to hypoxia, and can be regarded as one of the features classifying the hypoxic EEG and normal EEG.

Author

Hypoxia; Electroencephalography

20000114279 Institute of Space Medico-Engineering, Beijing, China

Physiological Evaluation of Vestibular Training Load

Wang, Lin-Jie, Institute of Space Medico-Engineering, China; Pei, Jing-Chen, Institute of Space Medico-Engineering, China; Tong, Bo-Lun, Institute of Space Medico-Engineering, China; Liu, Zhi-Qiang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 249-254; In Chinese; Copyright; Avail: Issuing Activity

To evaluate the effects of vestibular training by observing the variations of the physiological indices. It is helpful in grasping the training load, setting down and implementing the training plan. 10 healthy subjects received linear acceleration, continuous Coriolis acceleration and discontinuous Coriolis acceleration stimuli on different dates. The stimulus was stopped when there were slight autonomic nervous symptoms, ECG, EGG and BP were recorded before during and after the stimuli. Computerized Dynamic Posturograph (CDP) was tested before and after experiment. One subject finished the training of the three stimuli with only slight autonomic nervous symptoms. The CDP tests pre- and post-experiment indicated that for most subjects the contribution of vestibular function in maintaining dynamic posture equilibrium increased after the linear acceleration stimuli, but decreased after continuous Coriolis acceleration stimuli, and there was great individual difference after discontinuous Coriolis acceleration stimuli because the stimulation was relatively heavy. The equilibrium score in SOT2 decreased significantly after linear acceleration stimuli, and increased significantly after discontinuous Coriolis acceleration stimuli. The training methods we designed and used in this experiment are feasible, and the required training load can be reached. EGG, BP and the percentage of LF (low frequency) in ECG R-R power spectrum can reflect the subject's condition when the period stimuli stopped. It provided important reference in the determination of training stimulation load. Key words vestibular stimulus; vestibular function tests; acceleration; dynamic posture equilibrium tests; motion sickness; physiological parameters

Author

Coriolis Effect; Dynamic Tests; Loads (Forces); Motion Sickness; Signs and Symptoms; Training Evaluation; Vestibular Tests

20000114280 Tsinghua Univ., Lab. of Biomedical Engineering, Beijing, China

A Simulated Study of Effects of Simulated Hypovolemia on Cardiovascular Response to Orthostatic Stress

Hao, Wei-Ya, Tsinghua Univ., China; Zhang, Li-Fan, Tsinghua Univ., China; Wu, Xing-Yu, Tsinghua Univ., China; Zhang,

Wei-Ying, Tsinghua Univ., China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 259-262; In Chinese; Copyright; Avail: Issuing Activity

To study the effects of hypovolemia on cardiovascular response to orthostatic stress, and to investigate the role of hypovolemia in the mechanism of cardiovascular deconditioning and orthostatic intolerance induced by space weightlessness. The effects of loss of blood volume had been incorporated in the sub-model of blood redistribution in the model developed for simulating the cardiovascular response to lower body negative pressure (LBNP) - With the help of the model, we simulated the changes of heart rate (HR) and blood pressure (BP) during LBNP after 0 approx. 25 % loss of blood volume. When the amount of decrease of blood volume was less than 5 % of the total blood volume, HR and BP could be maintained in normal range during LBNP through baroreflex regulation. When the amount of the decrease of blood volume was more than 15 % of the total blood volume, HR and BP could be kept in normal range when the subject was supine and at rest. But BP fell sharply and the cardiovascular system almost collapsed during orthostatic exposure. Decrease of blood volume causes significant degradations of cardiovascular response to orthostatic stress.

Author

Hypovolemia; Cardiovascular System; Orthostatic Tolerance; Physiological Responses; Lower Body Negative Pressure; Weightlessness

20000114290 Institute of Space Medico-Engineering, Beijing, China

Change of Pulmonary Circulation in Microgravity and Simulated Microgravity

Sun, Lei, Institute of Space Medico-Engineering, China; Xiang, Qiu-Lu, Institute of Space Medico-Engineering, China; Wang, De-Sheng, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 305-309; In Chinese; Copyright; Avail: Issuing Activity

Fluid is transferred cephalad in microgravity and simulated microgravity, and the pulmonary circulation is the first to be affected. Blood and fluid contents in the lungs increase, but unevenly distributed among various zones of the lungs. Blood vessels in the lungs are filled and distend. Capillary changes have been observed in the animal model of simulated microgravity. Studies about the changes of regulative function of pulmonary circulation are relatively rare. Observations of the reactivity of pulmonary vessels may help to understand the mechanisms of the changes in pulmonary circulation during microgravity.

Author

Blood Vessels; Microgravity; Pulmonary Circulation; Weightlessness Simulation

20000114291 Institute of Space Medico-Engineering, Beijing, China

Ultraviolet Radiation and Long Term Space Flight

Wu, Hui-Bin, Institute of Space Medico-Engineering, China; Su, Shuang-Ning, Institute of Space Medico-Engineering, China; Ba, Fu-Sen, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 310-312; In Chinese; Copyright; Avail: Issuing Activity

With the prolongation of space flight, influences of various aerospace environmental factors on the astronauts become more and more severe, while ultraviolet radiation is lacking. Some studies indicated that low doses of ultraviolet rays are useful and essential for human body. In space flight, ultraviolet rays can improve the hygienic condition in the space cabin, enhance astronaut's working ability and resistance to unfavorable factors, prevent Mineral metabolic disorders, cure purulent skin diseases and deallergize the allergens. So in long-term space flight, moderate amount of ultraviolet rays in the space cabin would be beneficial.

Author

Ultraviolet Radiation; Human Body; Long Duration Space Flight; Metabolism

20000114820 Arkansas Univ., Little Rock, AR USA

Magnetic Resonance-Guided Interstitial Laser Photocoagulation for the Treatment of Breast Cancer Annual Report, I Aug. 1998 - 31 Jul. 1999

Harms, Steven E.; Aug. 1999; 16p; In English

Contract(s)/Grant(s): DAMD17-97-1-7087

Report No.(s): AD-A382429; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study assesses magnetic resonance (MR)-guided interstitial laser photocoagulation (ILP) for the treatment of breast cancer. ILP has been successfully used for the treatment of a variety of solid tumors, and recent studies have indicated the capability of ILP, which employs low level heat (50 centigrade) for about 10 minutes, to kill breast cancer tissue. Because breast cancer cells are often interspersed with surrounding normal tissue, making boundaries difficult to define by most diagnostic

imaging methods, MR imaging is used to define tumor margins and extent. Our research group has developed a high-contrast, high-resolution method for MR imaging of the breast, called RODEO (Rotating Delivery of Excitation Off-resonance), proven to have twice the sensitivity and specificity of mammography. Cellular death induced by ILP produces a phase change that can be visualized on MR images. This MRI hypointense zone can then be used to determine the adequacy of ILP treatment. The combination of RODEO imaging and a system for MRI-directed stereotaxic biopsy allows the accurate localization and placement of the laser fibers for ILP. This study tests the feasibility and outcome of MR-directed ILP in 30 patients with breast cancer who are scheduled for surgical removal of the lesion (mastectomy or lumpectomy). Our major findings to date are (1) RODEO MRI can accurately identify cancers for laser ablation; (2) Stereotaxic MRI needle positioning can be performed; (3) Fast RODEO MR can accurately depict zones of ablation for interactive ILP; (4) ILP is an effective method for the minimally invasive ablation of breast cancer; (5) MRI-guided ILP is safe and is a potential alternative to surgical lumpectomy; and (6) MRI-guided ILP may have lower costs and provide better cosmesis than surgical lumpectomy.

DTIC

Laser Beams; Magnetic Resonance; Mammary Glands; Cancer; Imaging Techniques

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20000105072 Institut de Medicine Aerospatiale Armee, Bretigny sur Orge, France

Sleep and Age: From Physiopathology to Therapeutics

Agarde, Dider I., Institut de Medicine Aerospatiale Armee, France; Catrycke, Marc, Institut de Medicine Aerospatiale Armee, France; Billaud, Philippe, Institut de Medicine Aerospatiale Armee, France; Ramont, Laurent, Institut de Medicine Aerospatiale Armee, France; Guilbaut, Bruno, Institut de Medicine Aerospatiale Armee, France; *Operational Issues of Aging Crewmembers*; August 2000, pp. 14B-1 - 14B-6; In English; See also 20000105060; Copyright Waived; Avail: CASI; A02, Hardcopy

Circadian rhythms and especially light/dark cycle have been studied using paraclinical (EEG, MSLT, actimetry) and biochemical (melatonin level) methods and neuropsychological tests which evaluate sleep disorders effects. These investigations allow to point out significant changes in sleep as soon as 35 years old. The purpose of this paper is to sum up current knowledge of age influence on sleep and therapeutic ways of good sleep quality recovery or wakefulness preservation, in military operational condition.

Author

Age Factor; Sleep; Sleep Deprivation; Wakefulness; Armed Forces (Foreign); Personnel

20000105078 Department of the Air Force, Brooks AFB, TX USA

Neuropsychiatric Aeromedical Referrals: Do Trends Vary with Age?

Orme, Daniel, Department of the Air Force, USA; Thompson, Bill, Department of the Air Force, USA; *Operational Issues of Aging Crewmembers*; August 2000, pp. 21-1 - 21-4; In English; See also 20000105060; Copyright Waived; Avail: CASI; A01, Hardcopy

Four hundred eighty one records of aviators evaluated at the Neuropsychiatry Branch of the USAF Aeromedical Consultation Service were reviewed to assess diagnostic trends among this group. Sixteen psychiatric diagnoses were variously represented in the sample with relatively mild disorders (reactive disorders -- 19.7 percent, other psychosocial problems -- 15.2 percent, and neurotic disorders -- 13.3 percent) accounting for nearly 50 percent (48.2) of the disorders. Younger aviators were significantly less likely ($p < .001$) to be seen for evaluation than older ones. Finally, diagnoses were not evenly distributed across all age groups; some diagnoses were more strongly associated with some age groups than others. Overall, results suggest some differential vulnerability to neuropsychiatric conditions depending upon the age of the aviator and the diagnosis in question.

Author

Neuropsychiatry; Psychotherapy; Mental Health; Aerospace Medicine

20000105204 Old Dominion Univ., Norfolk, VA USA

Pilot Personality Profile Using the NEO-PI-R

Fitzgibbons, Amy, Old Dominion Univ., USA; Davis, Don, Old Dominion Univ., USA; [2000]; 16p; In English
Contract(s)/Grant(s): NGT1-52193

Report No.(s): ODURF-182271; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper recounts the qualitative research conducted to determine if a general personality measure would provide a personality profile for commercial aviation pilots. The researchers investigated a widely used general personality inventory, the NEO-PI-R, with 93 pilots. The results indicate that a "pilot personality" does exist. Future research and implications are discussed.

Author

Aircraft Pilots; Neuropsychiatry; Aviation Psychology; Personality; Personality Tests; Psychological Tests

20000108678 Institute of Space Medico-Engineering, Beijing, China

Unsymmetrical Response Features of Left and Right Brain to Signals from Left and Right Visual Fields at Different Cognitive Levels

Wei, Jin-He, Institute of Space Medico-Engineering, China; Zhao, Lun, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Li, Da-Chen, Institute of Space Medico-Engineering, China; Yan, Gong-Dong, Institute of Space Medico-Engineering, China; Yang, Ming-Hao, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; June 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 157-161; In English; Copyright; Avail: Issuing Activity

Objective. to study the response characteristics of left and right brain to signals from left(LVF) and right(RVF) visual fields during cognitive activity. Method ERPs at 9 locations to LVF and RVF signals were compared in 23 normal subjects in 3 task conditions: looking forward only (VC); making switch response to target signals(T) only(SR); making switch response to T differentially(DR). Result. (1)Significant difference in ERPs was found between that induced by LVF and RVF signals on left brain especially at frontal location(F5), which appeared as slow negative deflection induced by T and NT from RVF in SR and DR; (2) Condition dependent unsymmetrical features between left and right brain were found: the slow potential at F5 was significantly more negative in T and contralateral spatial relation(i. e. , left brain for RVF) but more positive in NT and ipsilateral relation than that at F6. Conclusion. Signals with psychological meaning in RVF might cause more psychological load as suggested by the results obtained in this study.

Author

Brain; Cognition; Visual Fields; Symmetry

20000108686 Air Force Qingdao Sanatorium, Qingdao, China

Personality Analysis of Pilots on Active Duty

Dong, Xiao-Xin, Air Force Qingdao Sanatorium, China; Ren, Xiao-Min, Air Force Qingdao Sanatorium, China; Liu, Hui, Air Force Qingdao Sanatorium, China; Yang, Ju-Fang, Air Force Qingdao Sanatorium, China; Xiao, Long-Bin, Air Force Qingdao Sanatorium, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 204-206; In Chinese; Copyright; Avail: Issuing Activity

Objective. to investigate the factor construction of MMPI in pilots on active duty and its application in psychological assessment of pilots. Method. T scores of pilots were measured. Six common factors of P, N, 1, M, A and F were extracted with major component analysis and the loading matrix and factor construction were obtained by varimax orthogonal rotation. Result. Factor P, N, M, 1, A and F appeared in MMPI of pilots on active duty, which consistent with various studies in this field One difference was that factors N and F appeared in relevant MMPI in the form of negative loading. There were still some pilots whose factor scores exceeded the normal standard. Conclusion. MMPI has more structure validity in pilots on active duty. Factor analysis of MMPI can reflect the psychological quality of pilots. It was more comprehensive and more convenient to assess the psychological quality of pilots with factor analysis.

Author

Factor Analysis; Personality; Pilot Performance

20000109865 Army Aviation Research and Development Command, Moffett Field, CA USA

Sensitivity Analysis of Situational Awareness Measures

Shively, R. J., Army Aviation Research and Development Command, USA; Davison, H. J., San Jose State Univ., USA; Burdick, M. D., San Jose State Univ., USA; [2000]; 1p; In English; 14th; 14th Triennial HFES/IEA Conference, 30 Jul. - 4 aug. 2000, San Diego, CA, USA

Contract(s)/Grant(s): 21-1614-2360; RTOP 581-31-22; No Copyright; Avail: Issuing Activity; Abstract Only

A great deal of effort has been invested in attempts to define situational awareness, and subsequently to measure this construct. However, relatively less work has focused on the sensitivity of these measures to manipulations that affect the SA of the pilot. This investigation was designed to manipulate SA and examine the sensitivity of commonly used measures of SA. In this experiment, we tested the most commonly accepted measures of SA: SAGAT, objective performance measures, and SART, against different levels of SA manipulation to determine the sensitivity of such measures in the rotorcraft flight environment.

SAGAT is a measure in which the simulation blanks in the middle of a trial and the pilot is asked specific, situation-relevant questions about the state of the aircraft or the objective of a particular maneuver. In this experiment, after the pilot responded verbally to several questions, the trial continued from the point frozen. SART is a post-trial questionnaire that asked for subjective SA ratings from the pilot at certain points in the previous flight. The objective performance measures included: contacts with hazards (power lines and towers) that impeded the flight path, lateral and vertical anticipation of these hazards, response time to detection of other air traffic, and response time until an aberrant fuel gauge was detected. An SA manipulation of the flight environment was chosen that undisputedly affects a pilot's SA-- visibility. Four variations of weather conditions (clear, light rain, haze, and fog) resulted in a different level of visibility for each trial. Pilot SA was measured by either SAGAT or the objective performance measures within each level of visibility. This enabled us to not only determine the sensitivity within a measure, but also between the measures. The SART questionnaire and the NASA-TLX, a measure of workload, were distributed after every trial. Using the newly developed rotorcraft part-task laboratory (RPTL) at NASA Ames Research Center, each pilot flew eight trials, four using SAGAT and four using performance measures. Each set of four trials differed by level of visibility as well. The flight paths were very similar in appearance and hazard number, allowing comparison between flight paths. The pilots were tasked with flying along a road at an assigned altitude and speed while avoiding any hazards that they happened upon. The attempt here was not to find a single best measure of SA, but rather to begin an investigation of the sensitivity of common measures of SA. Upon completion of this study, its results, in combination with future studies, should allow us to develop an empirically based taxonomy of SA measures and the contexts for their appropriate use.

Author

Sensitivity; Pilot Performance; Human Factors Engineering

2000109961 NASA Ames Research Center, Moffett Field, CA USA

NASA's Design and Development of a Field Goniometer Instrument Using Solid Works

Turner, Mark, NASA Ames Research Center, USA; Sasaki, Glen, NASA Ames Research Center, USA; [2000]; 1p; In English; 14th; SolidWorks World 2000 Conference, 12-15 Jan. 2000, USA

Contract(s)/Grant(s): 21-1614-2360; RTOP 581-31-22; No Copyright; Avail: Issuing Activity; Abstract Only

With NASA suffering severe funding cutbacks, engineers at NASA are required to produce state-of-the-art hardware with limited personnel and financial resources. In light of these constraints, the new NASA mandate is to build better, faster and cheaper. In April of 1998, Stennis Space Center's Commercial Remote Sensing Program contracted to the Systems Engineering Division at NASA Ames Research Center to develop a device known as a Field Goniometer. A Field Goniometer is a device that measures bi-directional reflectance of a target, such as vegetation, relative to the sun and an imaging system in an aircraft or spacecraft. The device is able to provide a spectral fingerprint of the surface it is measuring in wavelengths from 350nm-2500nm using a hyperspectral imager. To accomplish this project, several obstacles had to be overcome. First, the design had to be completed in less than four months. Second, due to the complexity of the design, the use of solid modeling was highly desirable but most of the group's solid modelers were assigned to other jobs. Third, the amount of funding available from the customer was one half to one third the funding typically expended for a job of this nature. Our choices for this project were to design with standard 2-D CAD systems currently used in-house or train additional engineers on our existing solids package or purchase a new solid model package. The use of a 2D CAD system was very undesirable due to the complexity of the design. Using our existing solids modeler would have required a learning curve for our engineers that would be incompatible with our schedule. Prior to this project, a member of our design group researched the solid modeling industry and decided to purchase SolidWorks. After examining the product for ease of use, modeling capability, training time required and cost, we decided our highest probability of success would be to design with Solidworks. During the design phase, our fabrication group was able to provide input at the very early stages, which added significant benefit to the final product. Fabrication cost and schedule savings have been realized by having complex part geometries translated directly from the SolidWorks design models to Surfcam and other computer-aided manufacturing (CAM) software. This direct model translation capability optimized the fabrication processes. The end result was that we were able to successfully complete the project on time and on budget. Other advantages of using SolidWorks, as cited by the design team, include a rapid negotiation of the initial learning curve, the ability to develop solid model hardware prototypes (used to communicate the design intent to both the customer and the fabricator), and the ability to work as a team collaborating on a large, complex model. These types of tools and efforts represent our response to NASA's challenge to produce higher quality products within shorter design and fabrication times.

Author

Fabrication; Goniometers; Design Analysis; Measuring Instruments; Systems Engineering; Remote Sensing

20000110868 Civil Aeromedical Inst., Oklahoma City, OK USA

The Relationship Between Aviators' Home-Based Stress to Work Stress and Self-Perceived Performance *Final Report*
Fiedler, Edna R., Civil Aeromedical Inst., USA; Della Rocco, Pam S., Civil Aeromedical Inst., USA; Schroeder, David J., Civil Aeromedical Inst., USA; Nguyen, Kiet T., Civil Aeromedical Inst., USA; October 2000; 12p; In English
Contract(s)/Grant(s): AM-B-99-HRR-518

Report No.(s): DOT/FAA/AM-00/32; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper investigates the relationship between domestic-based stress and pilots' perceptions of their effectiveness in the cockpit and in the office. Despite the importance placed on the family as a source of social support, there have been few systematic studies of the relationships between pilot family life, workplace stress, and performance. As part of a larger study, 19 USA Coast Guard (USCG) helicopter pilots at two air stations completed a stress questionnaire (adapted from Cooper and Sloan, 1986), rated the importance of various coping strategies, and evaluated their own flying performance. The results of this study indicate that the effects of domestic stress carry over to the pilots' work world, directly influencing work stress and indirectly affecting pilots' perceptions of their flying performance. The positive influence of home life in mediating stress was noted when pilots were asked to rate the importance of various coping strategies. Pilots rated three aspects of home life as the most "important" factors in helping them cope with problems or stress. Thus, domestic-related issues were very important to this group of USCG pilots, suggesting the need for management to maintain awareness of how the quality of home life may affect the work environment and overall performance.

Derived from text

Aircraft Pilots; Aviation Psychology; Psychological Effects; Psychological Factors; Stress (Psychology); Pilot Performance

2000011086 NASA Johnson Space Center, Houston, TX USA

Training Select-in Interviewers for Astronaut Selection: A Program Evaluation

Hysong, S., Wyle Labs., Inc., USA; Galarza, L., Wyle Labs., Inc., USA; Holland, A., NASA Johnson Space Center, USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Psychological factors critical to the success of short and long-duration missions have been identified in previous research; however, evaluation for such critical factors in astronaut applicants leaves much room for human interpretation. Thus, an evaluator training session was designed to standardize the interpretation of critical factors, as well as the structure of the select-in interview across evaluators. The purpose of this evaluative study was to determine the effectiveness of the evaluator training sessions and their potential impact on evaluator ratings.

Derived from text

Astronaut Training; Space Psychology; Training Analysis; Personnel Development

20000112923 NASA Ames Research Center, Moffett Field, CA USA

Physiologic and Functional Responses of MS Patients to Body Cooling Using Commercially Available Cooling Garments
Ku, Yu-Tsuan E., Lockheed Martin Engineering and Sciences Co., USA; Montgomery, Leslie D., Lockheed Martin Engineering and Sciences Co., USA; Lee, Hank C., Lockheed Martin Engineering and Sciences Co., USA; Luna, Bernadette, NASA Ames Research Center, USA; Webbon, Bruce W., NASA Ames Research Center, USA; [1999]; 24p; In English

Contract(s)/Grant(s): RTOP 251-10-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Personal cooling systems are widely used in industrial and aerospace environments to alleviate thermal stress. Increasingly they are also used by heat sensitive multiple sclerosis (HSMS) patients to relieve symptoms and improve quality of life. There are a variety of cooling systems commercially available to the MS community. However, little information is available regarding the comparative physiological changes produced by routine operation of these various systems. The objective of this study was to document and compare the patient response to two passive cooling vests and one active cooling garment. The Life Enhancement Technology, Inc. (LET) lightweight active cooling vest with cap, the MicroClimate Systems (MCS) Change of Phase garment, and the Steele Vest were each used to cool 13 male and 13 female MS subjects (31 to 67 yr.) in this study. The subjects, seated in an upright position at normal room temperature (approximately 22 C), were tested with one of the cooling garments. Oral, right and left ear temperatures were logged manually every 5 min. An-n, leg, chest and rectal temperatures; heart rate; and respiration were recorded continuously on a U.F.I., Inc. Biolog ambulatory monitor. Each subject was given a series of subjective and objective evaluation tests before and after cooling. The LET and Steele vests test groups had similar, significant (P less than 0.01) cooling effects on oral and ear canal temperature, which decreased approximately 0.4 C, and 0.3 C, respectively. Core temperature increased (N.S.) with all three vests during cooling. The LET vest produced the coldest (P less than 0.01) skin temperature. Overall, the LET vest provided the most improvement on subjective and objective performance measures. These results show that the garment configurations tested do not elicit a similar thermal response in all MS patients. Cooling with the LET active garment

configuration resulted in the lowest body temperatures for the MS subjects; cooling with the MCS vest was least effective. For functional responses, the LET test group performed better than the other two vests.

Author

Physiological Responses; Body Temperature; Cooling Systems; Garments; Diseases; Nervous System

20000113409 Eastern Virginia Medical School, Behavioral Medicine Clinic, . Norfolk, VA USA

Stress Counter-Response Training Via Physiological Self-Regulation During Flight Simulation, 29 Jul. 1998 - 30 Jun. 2000

Palsson, Olafur S., Eastern Virginia Medical School, USA; [2000]; 10p; In English

Contract(s)/Grant(s): NCC1-310; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This study provided the first evaluation of a new training concept and technology aimed at training pilots to maintain physiological equilibrium during circumstances in an airplane cockpit. Thirty healthy subjects (16 males and 14 females) between the ages of 18 and 35 were randomized into two study groups, A and B. Subjects participated individually in a sequence of four study sessions. In the first visit, subjects were taught to operate a desktop fighter jet flight simulation program. In the three sessions that followed, subjects in group A were trained to minimize their autonomic deviation from baseline values while operating the desktop flight simulation. This was done by making their skin conductance and hand temperature deviations from baseline impair the functionality of the aircraft controls. Subjects also received auditory and visual cues about their autonomic deviation, and were instructed to keep these within pre-set limits to retain full control of the aircraft. Subjects in group B were subjected to periods of impaired aircraft functionality independent of their physiologic activity, and thus served as a control group. No statistically significant group differences were found in the flight performance scores from the three training sessions, and post-training flight performance scores of the two groups were not different. We conclude that this study did not provide clear support for this training methodology in optimizing pilot performance. However, a number of shortcomings in the current status of this training methodology may account for the lack of demonstrable training benefit to the experimental group. Suggested future modifications for research on this training methodology include: Limiting the amount of instrument impairment resulting from physiological deviations; conducting a greater number of physiological training sessions per subject; using pre-post training performance tests which invoke a greater amount of stress in subjects; and developing a more detailed performance scoring system.

Author

Flight Simulation; Flight Stress (Biology); Psychophysiology; Pilot Performance; Autonomic Nervous System

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

20000105137 NASA Johnson Space Center, Houston, TX USA

NASA/Mir Food Experience

Bourland, Charles T., NASA Johnson Space Center, USA; Kloeris, Vickie L., NASA Johnson Space Center, USA; [1999]; 4p; In English; Environmental Systems, 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA; Copyright; Avail: Issuing Activity

The NASA/Mir food system was based on a plan that included 50% U.S. food and 50% Russian food. Using inputs from crew evaluations, nutritional requirements, and analytical data, menus for each Long Duration Mission (LDM) were developed by the U.S. and Russian food specialists. The cosmonaut's planned menus were identical while the astronaut's menu differed slightly, based on personal preferences. Bonus food containers of astronaut's favorite foods were provided to increase variety. Six out of 7 astronauts reported that the menu plan was seldom, if ever, followed. Five out of 7 astronauts ate most of their meals with the other crew members. In most cases, the bonus food containers were not opened until near the end of the mission. All crew members emphasized that variety was critical and that the use of Mir and Shuttle food together added a unique variety to the food system. Three of the 7 Mir astronauts lost significant weight during their stay on Mir. The length of stay varied from 116 to 188 days.

Author

Astronauts; Cosmonauts; Nutritional Requirements; Space Flight Feeding; Consumables (Spacecrew Supplies); Eating

20000108677 Institute of Space Medico-Engineering, Beijing, China

Detection of Microbes Adherent to Particles in a Closed Environment

Yu, Fang, Institute of Space Medico-Engineering, China; He, Xin-Xing, Institute of Space Medico-Engineering, China; Xie, Qiong, Institute of Space Medico-Engineering, China; Jiang, Jie, Institute of Space Medico-Engineering, China; Space Medicine

and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 210-214; In Chinese; Copyright; Avail: Issuing Activity

Objective. In order to provide reference for controlling and monitoring the environmental contamination in the spacecraft, the species and amount of microbes, which adhere to the suspended particles with different size in a closed environment were detected. Method According to USA EPA IP - 10, particles were continuously sampled by an impactor in a closed environment. The particles were divided into three grades by their aerodynamic diameters (AD): 100 microns greater than or = AD greater than 10 microns, 10 microns greater than or = AD greater than 2 microns and AD less than or = 2 microns. Clean outdoor air was collected as control by the same way. The collected particles were precisely weighed. The microbes that adhere to the particles were cultivated, counted and identified. Result. by calculating total suspended particles (TSP) and inhalant particles (IP) of the closed environment, counting, clarifying and identifying the microbes, 6 kinds of bacteria, 2 genus of actinomyces and 6 kinds of fungi that adhere to the particles were detected. Conclusion. The particles in a closed environment may have some effect on human health and instruments.

Author

Air Quality; Bacteria; Closed Ecological Systems; Detection; Microorganisms

20000108679 Institute of Aviation Medicine, Beijing, China

The Protection Against +Gz Afforded by Pressure Breathing with Different Pressure Schedules

Geng, Xi-Chen, Institute of Aviation Medicine, China; Zhan, Chang-Lu, Institute of Aviation Medicine, China; Yan, Gui-Ding, Institute of Aviation Medicine, China; Chu, Xu, Institute of Aviation Medicine, China; Lu, Xia, Institute of Aviation Medicine, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 166-170; In English; Copyright; Avail: Issuing Activity

Objective. System of pressure breathing for + Gz (PBG) has been incorporated into service in the high performance fighter aircraft, but there were significant differences among PBG pressure schedules used in different countries. The purpose of this study was to define an optimal pressure schedule in PBG system. Method. Five male subjects wearing GZ-2 anti-G suit and medium-sized bladder vest, plus PBG with 1.6, 2.4, and 3.2 kPa/G pressure schedules, respectively, were exposed to rapid onset (3.0 G/s) centrifuge + Gz runs. + Gz protection of PBG with each of the three pressure schedules were measured and the subjective ratings were collected. Result. The + Gz protection afforded by PBG with 1.60, 2.40, and 3.20 kPa/G pressure schedules were 2.00 +/- 0.31, 2.54 +/- 0.32, and 2.44 +/- 0.31 G, respectively. Subjective ratings showed that the PBG with 2.40 kPa/G pressure schedule was better than the other two. Conclusion. Our data suggest that a PBG pressure schedule of 2.4 kPa/G in PBG system is optimal. It not only assures the anti-G performance of PBG, but also reduces its side effects.

Author

Acceleration Stresses (Physiology); Countermeasures; Pressure Breathing; Protection

20000108680 Tsinghua Univ., Dept. of Engineering Mechanics, Beijing, China

Numerical Study of Ventilation and Heat Transfer Performance in a Square Space

Wu, Qun-Gang, Tsinghua Univ., China; Liang, Xin-Gang, Tsinghua Univ., China; Ren, Jian-Xun, Tsinghua Univ., China; Guo, Zeng-Yuan, Tsinghua Univ., China; Chen, Ze-Jing, Tsinghua Univ., China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 174-178; In Chinese; Copyright; Avail: Issuing Activity

Objective. to investigate the ventilation organization in a square space with slot inlet and oblique inlet flow and to try afford some useful suggestion for the design of ventilation. Method. Based on physical model, control equations depicting the ventilation and heat transfer in cabin were given. The inlet air direction, velocity, temperature, convective heat transfer capability and environment amenity were numerically simulated with staggered grid SIMPLE method. Result. As far as the cases of oblique inlet flow direction were concerned, the research indicated that the heat transfer capability, the homogeneity, amenity and effectiveness of input energy were acceptable although the flow patterns were asymmetric. When the angle between the inlet flow direction and ceiling was smaller than 45 degree, there were better homogeneity of temperature and velocity fields. The heat transfer performance, was not sensitive to the inlet flow angle. Conclusion. The 2D ventilation configuration with oblique inlet flow direction has good thermal performance but the control of flow pattern is not satisfactory. It is possible to improve the homogeneity of temperature and velocity, heat transfer capability and the control of flow pattern simultaneously by proper organization of vertical line (vector) V central dot $(\Delta)T$ vertical line. The research recommends independent inlet apertures with adjustable angle between 30 approx. 45 degree.

Author

Numerical Analysis; Ventilation; Temperature Effects; Space Capsules; Convective Heat Transfer

20000108681 Institute of Space Medico-Engineering, Beijing, China

The Study on CO₂ Concentration in Solid Amine CO₂ Control System

Zhou, Kang-Han, Institute of Space Medico-Engineering, China; Lu, Xi-Yu, Institute of Space Medico-Engineering, China; Ai, Shang-Kun, Institute of Space Medico-Engineering, China; Liu, Cheng-Liang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Jun. 2000; ISSN 1002-0837; Volume 13, No. 3, pp. 179-182; In Chinese; Copyright; Avail: Issuing Activity

Objective. to solve the problem of CO₂ concentration and collection in solid amine CO₂ control system for long-duration spacecraft cabin. Method. One approach was presented on the base of the principle of absorption and desorption, and was then tested by the apparatus according to it. Result. The average concentration of the concentrated CO₂ has as high as 95 % , which can be directly sent to the CO₂ reduction system, and about 90 % of the concentrated CO₂ can be collected. Conclusion. The designed apparatus met the requirements of the CO₂ reduction system.

Author

Carbon Dioxide Concentration; Amines; Solid Cryogenes

20000108715 Naval Air Warfare Center, Aircraft Div., Patuxent River, MD USA

Physiological Responses to Wearing the Helicopter Aircrew Integrated Life Support System (HAILSS) in Hot Environments *Final Report*

Kaufman, J. W.; Shender, B. S.; Askew, G. K.; Schaaf, L.; Farahmand, K.; Aug. 08, 2000; 51p; In English
Report No.(s): AD-A381402; NAWCADPAX-99-189-TR; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Individuals wearing encapsulating garments require auxiliary cooling systems to sustain physical and cognitive performance when exposed to high temperatures or workloads. The Helicopter Aircrew Integrated Life Support System (HAILSS) is designed to minimize thermal problems by incorporating normal flight suit functions with protective functions (fire, chemical and biological warfare (CBW), and cold water immersion) in a single, integrated clothing ensemble. This study evaluated the effectiveness of the HAILSS cooling concept by comparing heat loads incurred while performing up to 6 hi of physical work in either HAILSS or the current A/P22P-9(V) CBW protective ensemble. This study exposed seven test subjects (six male, one female) to six experimental trials each. Subjects wore the HAILSS (h20, h75) and CB (m20, HAILSS% N" 75" 35" a) Need for head ventilation b) Airflow though breathing valve adequate but saliva a problem, "mouth too were M.L.nt moderate physical work (40% of an individual's maximum oxygen uptake) and cognitive tasks. In addition, each subject had one exposure using HA%S without the chemical protective AR-5 hood (h75n) and another employing HAILSS with cooled ventilation air (24C inlet air temperature) (h75c) in the hot/humid condition. Test results indicated 20% RH trials lasted significantly longer (p<0.01)andweresignificantlyless stressful (p<0.05)than75%RHtrialsbasedn various physiological parameters. Increasing heat removal by ancillary cooling brought the level of heat strain experienced in the HAILSS assemble at 75% RH to roughly that of Mk 1 or HAILSS at 20% RH. HAILSS or Mk I without ancillary cooling was demonstrably more stressful to wear at 75% RH than at 20% RH. Operational mission performance would likely degrade at this higher RH without active cooling. These results demonstrate that ambient relative humidity significantly affects heat removal even in totally encapsulated protective clothing ensembles.

DTIC

Life Support Systems; Human Performance; Exposure; Protective Clothing; Stress (Physiology); Tolerances (Physiology); Flight Crews; Physiological Responses

20000108920 NASA Johnson Space Center, Houston, TX USA

Design of a 2-Hour Prebreathe Protocol for Space Waks (EVAs) from the International Space Station (ISS)

Gernhardt, M. L., NASA Johnson Space Center, USA; Conkin, J., Baylor Coll. of Medicine, USA; Foster, P. P., Baylor Coll. of Medicine, USA; Pilmanis, A. A., Armstrong Lab., USA; Butler, B. D., University of Texas Medical School, USA; Fife, C., University of Texas Medical School, USA; Vann, R. D., Duke Univ., USA; Gerth, W. A., Duke Univ., USA; Loftin, K. C., Wyle Labs., Inc., USA; Dervay, J., NASA Johnson Space Center, USA; Waligora, J. M., Waligora (J. M.), USA; Powell, M. R., NASA Johnson Space Center, USA; [2000]; 1p; In English; AsMA Annual Scientific Meeting, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The majority of extravehicular activities (EVAs) performed from the shuttle use a 10.2 psi staged decompression. The International Space Station (ISS) will operate at 14.7 psi, requiring crews to "campout" in the airlock at 10.2 psi. The constraints associated with campout (crew isolation, oxygen usage, and waste management), provided the rationale to develop a 2-hour prebreathe protocol from 14.7 psi. Previous studies on the affect of microgravity and exercise during prebreathe suggested the feasibility of this approach. Various combinations of adynamia (nonwalking subjects), prebreathe exercise doses, and space suit donning options (10.2 vs. 14.7 psi) were analyzed against timeline and consumable constraints. Prospective decompression

sickness (DCS) and venous gas emboli (VGE) accept/reject criteria were defined from statistical analysis of historical DCS data, combined with risk management of DCS under ISS mission circumstances. Maximum operational DCS levels were defined based on protecting for EVA capability with two crew members at 95% confidence, throughout ISS lifetime (within the constraints of NASA DCS disposition policy JPG 1800.3). The accept / reject limits were adjusted for greater safety (including Grade IV VGE criteria) based on analysis of related medical factors. Monte-Carlo simulation was performed to design a closed sequential, multi-center laboratory trial, including the capability of rejecting the primary protocol and testing at least one alternate exercise dose, within the 2-hour prebreathe. The 2-hour protocol incorporates 0, breathing for 50 min at 14.7 psi, including 10 min dual cycle ergometry at 75%VO₂max. It requires an additional 30 min O₂ breathing during depress from 14.7 to 10.2 psi, followed by a 30-60 min suit donning break at 10.2 psi/26.5% O₂. It concludes with a 40 min in-suit O₂ prebreathe. The protocol would be accepted for operations, if the incidence of DCS was less than 15% and Grade IV VGE less than 20%, both at 95% confidence. The above protocol and accept/reject limits were implemented in a multi-center study.

Author

Decompression Sickness; Extravehicular Activity; Oxygen; Pressure Reduction; Oxygen Breathing; Aerospace Medicine; Bioastronautics

20000109704 Lockheed Martin Space Mission Systems and Services, Houston, TX USA

Ergonomic Evaluation of Space Shuttle Light-Weight Seat Lever Position and Operation Final Report

Maida, J., NASA Johnson Space Center, USA; Rajulu, Sudhakar L., Lockheed Martin Space Mission Systems and Services, USA; [2000]; 1p; In English, 30 Jul. - 4 Aug. 2000, San Diego, CA, USA; Sponsored by International Ergonomics Association Contract(s)/Grant(s): NAS9-18800; No Copyright; Avail: Issuing Activity; Abstract Only

During a Shuttle flight in the early part of 1999, one of the crewmembers was unable to operate the backrest lever for the light-weight seat in microgravity. It is essential that the crewmembers are able to adjust this back-rest lever, which is tilted forward 2 degrees from vertical during launch and then moved backwards to 10 degrees aft of vertical upon reaching orbit. This adjustment is needed to cushion the crewmembers during an inadvertent crash landing situation. The original Shuttle seats, which had seat controls located on the front left and right sides of the seat, were replaced recently with the new light-weight seats. The controls for these new, seats were moved to the right side with one control at the front and the other at the back. While it was uncertain whether the problem encountered was unique to that crewmember or not it was clear to the personnel responsible for maintaining the Shuttle seats that not knowing the cause of the problem posed a safety concern for NASA. Hence the Anthropometry and Biomechanics Facility (ABF) of the Johnson Space Center was requested to perform an evaluation of the seat controls and provide NASA with appropriate recommendations on whether the seat lever positions and operations should be modified. The ABF designed an experiment to investigate the amount of pull force exerted by subjects, wearing an unpressurized or pressurized crew launch escape suit, when controls were placed in the front and back (on the right side) of the light-weight seat. Single-axis load cells were attached to the seat levers, which measured the maximum static pull forces that were exerted by the subjects. Twelve subjects, six male and six female, participated in this study. Each subject was asked to perform the pull test at least three times for each combination of lever position and suit pressure conditions. The results from this study showed that as a whole (or in general), the subjects were able to pull on the lever at the back position with only about half the amount of force that they were able to exert on the lever at the front position. In addition, the results also showed that subjects wearing the pressurized suit were unable to reach the seat lever when it was located at the back. Furthermore, the pull forces on the front lever diminished about 50 % when subjects wore the pressurized suits. Based on these results from this study, it was recommended to NASA that the levers should not be located in the back position. In addition, further investigation is needed on whether the levers at the front of the seat could be modified or adjusted to increase the leverage for crew members wearing pressurized launch/escape suits.

Author

Levers; Seats; Human Factors Engineering; Astronaut Performance

20000109870 Norwegian Defence Research Establishment, Kjeller, Norway

Test of Adsorption Capacity of Protecting Materials Adsorpsjonstesting av Vernematerialer

Haldorsen, Tone Merete, Norwegian Defence Research Establishment, Norway; Roen, Bent Tore, Norwegian Defence Research Establishment, Norway; Busmundrud, Odd, Norwegian Defence Research Establishment, Norway; Skas, Bjornar Lowe, Norwegian Defence Research Establishment, Norway; Sep. 01, 2000; 26p; In Norwegian; Original contains color illustrations Contract(s)/Grant(s): FFIBM Proj. 757/138

Report No.(s): FFI/RAPPORT-2000-04404; ISBN-82-464-0437-7; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NM143 NBC protective suit used by the Norwegian armed forces and the NBC protective underliner in use for pilots has been examined regarding their adsorption capacities. Penetration analyses were performed with mustard gas at a

contamination level of 10 Mg/sq cm. The underliner together with the pilot survival suit gives an accumulated penetrated amount over 24 hours of less than 0.5 microg/sq cm. Penetration analyses on NM143 materials give significant higher penetrated amount on a ready-made suit from March 1990 than for yard goods from the same period. However, both materials satisfy the requirement of less than 4 microg/sq cm total penetrated amount over 24 hours. Adsorption isotherms are measured on the materials at 90 C with methyl salicylate. The underliner shows better adsorption capacity than the NM143 inner materials at vapor concentrations below $2 * 10^{(exp -4)}$ P/P(sub 0) but lower adsorption capacity at higher concentrations. No significant difference was measured in adsorption capacity between NM143 materials from suit and materials from yard goods. A laundering test on the NM143 suit shows lower adsorption capacity of the inner material after one laundering.

Author

Protective Clothing; Flight Clothing; Adsorption

20000109874 NASA Johnson Space Center, Houston, TX USA

Two-Phase Technology at NASA/Johnson Space Center

Ungar, Eugene K., NASA Johnson Space Center, USA; [1999]; 1p; In English; Two-Phase Technology 1999, 17-19 May 1999, College Park, MD, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Since the baseline International Space Station (ISS) External Active Thermal Control System (EATCS) was changed from a two-phase mechanically pumped system to a single phase cascade system in the fall of 1993, two-phase EATCS research has continued at a low level at JSC. One of the lessons of the ISS EATCS selection was that two-phase thermal control systems must have significantly lower power than comparable single phase systems to overcome their larger radiator area, larger line and fluid mass, and perceived higher technical risk. Therefore, research at JSC has concentrated on low power mechanically pumped two-phase EATCSs. In the presentation, the results of a study investigating the trade of single and two-phase mechanically pumped EATCSs for space vehicles will be summarized. The low power two-phase mechanically pumped EATCS system under development at JSC will be described in detail and the current design status of the subscale test unit will be reviewed. Also, performance predictions for a full size EATCS will be presented. In addition to the discussion of two-phase mechanically pumped EATCS development at JSC, two-phase technologies under development for biological water processing will be discussed. These biological water processor technologies are being prepared for a 2001 flight experiment and subsequent usage on the TransHab module on the International Space Station.

Author

International Space Station; Active Control; Temperature Control; Systems Engineering

20000109876 Lockheed Martin Space Operations, Houston, TX USA

Development of the ECLSS Sizing Analysis Tool and ARS Mass Balance Model Using Microsoft Excel

McGlothlin, E. P., Lockheed Martin Space Operations, USA; Yeh, H. Y., Lockheed Martin Space Operations, USA; Lin, C. H., NASA Johnson Space Center, USA; [1999]; 1p; In English; 29th; 29th ICES, 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): PWC-260981; No Copyright; Avail: Issuing Activity; Abstract Only

The development of a Microsoft Excel-compatible Environmental Control and Life Support System (ECLSS) sizing analysis "tool" for conceptual design of Mars human exploration missions makes it possible for a user to choose a certain technology in the corresponding subsystem. This tool estimates the mass, volume, and power requirements of every technology in a subsystem and the system as a whole. Furthermore, to verify that a design sized by the ECLSS Sizing Tool meets the mission requirements and integrates properly, mass balance models that solve for component throughputs of such ECLSS systems as the Water Recovery System (WRS) and Air Revitalization System (ARS) must be developed. The ARS Mass Balance Model will be discussed in this paper.

Author

Environmental Control; Life Support Systems; Air Purification; Water Reclamation

20000110015 NASA Johnson Space Center, Houston, TX USA

Hybrid Modeling for Testing Intelligent Software for Lunar-Mars Closed Life Support

Malin, Jane T., NASA Johnson Space Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Intelligent software is being developed for closed life support systems with biological components, for human exploration of the Moon and Mars. The intelligent software functions include planning/scheduling, reactive discrete control and sequencing, management of continuous control, and fault detection, diagnosis, and management of failures and errors. Four types of modeling information have been essential to system modeling and simulation to develop and test the software and to provide operational model-based what-if analyses: discrete component operational and failure modes; continuous dynamic performance within

component modes, modeled qualitatively or quantitatively; configuration of flows and power among components in the system; and operations activities and scenarios. CONFIG, a multi-purpose discrete event simulation tool that integrates all four types of models for use throughout the engineering and operations life cycle, has been used to model components and systems involved in the production and transfer of oxygen and carbon dioxide in a plant-growth chamber and between that chamber and a habitation chamber with physicochemical systems for gas processing.

Author

Life Support Systems; Artificial Intelligence; Moon; Mars (Planet); Software Development Tools; Hybrid Computers; Mathematical Models; Performance Tests

20000110017 NASA Johnson Space Center, Houston, TX USA

Modulation of Head Movement Control During Walking

Mulavara, Ajitkumar P., Wyle Labs., Inc., USA; Verstraete, Mary C., Akron Univ., USA; Bloomberg, Jacob J., NASA Johnson Space Center, USA; [1999]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

The purpose of this study was to investigate the coordination of the head relative to the trunk within a gait cycle during gaze fixation. Nine normal subjects walked on a motorized treadmill driven at 1.79 m/sec (20 s trials) while fixing their gaze on a centrally located earth-fixed target positioned at a distance of 2m from their eyes. The relative motion of the head and the net torque acting on it relative to the trunk during the gait cycle were used as measures of coordination. It was found that the net torque applied to the head counteracts the destabilizing forces acting on the upper body during locomotion. The average net torque impulse was significantly different (p less than 0.05) between the heel strike and swing phases and were found to be symmetrical between the right and left leg events of the gait cycle. However, the average net displacement of the head relative to the trunk was maintained uniform (p greater than 0.05) throughout the gait cycle. Thus, the coordination of the motion of the head relative to the trunk during walking is dynamically modulated depending on the behavioral events occurring in the gait cycle. This modulation may serve to aid stabilization of the head by counteracting the force variations acting on the upper body that may aid in the visual fixing of targets during walking.

Author

Head Movement; Modulation; Walking; Aerospace Medicine; Control Theory

20000110097 NASA Johnson Space Center, Houston, TX USA

Design and Testing of a 2-Hour Oxygen Prebreathe Protocol for Space Walks from the International Space Station

Gernhardt, Michael L., NASA Johnson Space Center, USA; Conkin, J., Baylor Coll. of Medicine, USA; Foster, P. P., Baylor Coll. of Medicine, USA; Pilmanis, A. A., Armstrong Lab., USA; Butler, B. D., University of Texas Medical School, USA; Beltran, E., University of Texas Medical School, USA; Fife, C. E., University of Texas Medical School, USA; Vann, R. D., Duke Univ., USA; Gerth, W. A., Duke Univ., USA; Loftin, K. C., Wyle Labs., Inc., USA; [2000]; 1p; In English; Undersea and Hyperbaric Medical Society, 18-22 Jun. 2000, Stockholm, Sweden; No Copyright; Avail: Issuing Activity; Abstract Only

To develop and test a 2-hour prebreathe protocol for performing extravehicular activities (EVAs) from the International Space Station (ISS). Combinations of adynamia (non-walking), prebreathe exercise, and space suit donning options (10.2 vs. 14.7 psi) were evaluated, against timeline and consumable constraints to develop an operational 2- hour prebreathe protocol. Prospective accept/reject criteria were defined for decompression sickness (DCS) and venous gas emboli (VGE) from analysis of historical DCS data, combined with risk management of DCS under ISS mission circumstances. Maximum operational DCS levels were defined based on protecting for EVA capability with two crew-members at 95% confidence, throughout ISS lifetime (within the constraints of NASA DCS disposition policy JPG 1800.3). The accept/reject limits were adjusted for greater safety based on analysis of related medical factors. Monte-Carlo simulation was performed to design a closed sequential, multi-center human trial. Protocols were tested with 4 different prebreathe exercises (Phases I-IV), prior to exposure to 4.3 psi for 4 hrs. Subject selection, Doppler monitoring for VGE, test termination criteria, and DCS definitions were standardized. Phase I: upper and lower body exercises using dual-cycle ergometry (75% VO₂ max for 10 min). Phase II: ergometry plus 24 min of light exercise (simulating space-suit preparations). Phase III: same 24 min of light exercise but no ergometry, and Phase IV: 56 min of light exercise without ergometry. A prebreathe procedure was accepted if, at 95% confidence, the incidence of DCS was less than 15% (with no Type II DCS), and Grade IV VGE was less than 20%.

Derived from text

International Space Station; Walking; Oxygen Breathing; Aerospace Medicine; Breathing Apparatus; Design Analysis; Performance Tests; Protocol (Computers)

20000113037 Biosphere 2 Center, Oracle, AZ USA

Biosphere 2 Center: Past, Present and Future

Harris, William C., Biosphere 2 Center, USA; Fine, Leonard W., Columbia Univ., USA; Friedman, Morton B., Columbia Univ., USA; National Educators' Workshop. Update 1999: Standard Experiments in Engineering, Materials Science and Technology; October 2000, pp. 145-150; In English; See also 20000113027; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

Columbia University assumed responsibility for the Biosphere 2 Center January 1, 1996 with the goal of building a new campus that focused on earth systems science, policy and management. Academic programs are now offered year round and we benefit by working with 25 university and college partners. Our research effort is now receiving external funding, following a major investment in re-configuring the Biosphere 2 apparatus and converting into a laboratory for controlled studies to determine the impact of high CO₂ on oceans (coral reefs), agroforestry systems (carbon sequestration) and a rain forest model. How did Columbia University get involved in this new activity is a fascinating story - which will be outlined during the presentation.

Derived from text

Biosphere; Test Facilities; Research Facilities; Laboratories; Experimentation

20000114282 Institute of Space Medico-Engineering, Beijing, China

Design of Reaction Canister in a Solid Amine Carbon Dioxide Removal System

Zhou, Kang-Han, Institute of Space Medico-Engineering, China; Lu, Xi-Yu, Institute of Space Medico-Engineering, China; Liu, Xiang-Yang, Institute of Space Medico-Engineering, China; Ai, Shang-Kun, Institute of Space Medico-Engineering, China; Liu, Cheng-Liang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 272-276; In Chinese; Copyright; Avail: Issuing Activity

To design a reaction canister using in solid amine carbon dioxide removal system for long-duration spaceflight. On consideration of system demand and properties of solid amine, key problems must be solved were found out: 1) the rated resistance limit tends to shorten the length of the canister while absorption and concentration require to increase the length of the canister; 2) limited quantity of heat for keeping the temperature of the canister; 3) inflation or contraction of the solid amine under micro-gravity. After appropriate measures were taken, effective adsorption and desorption, as well as concentration of CO₂ were achieved, the concentration of CO₂ in the space cabin could be controlled below 0 - 5 %; and the concentration of the concentrated CO₂ was as high as 98 % so that it could be directly send to the CO₂ reduction system; and that the resistance of the canister was below 160 mm H₂O; moreover , the energy consumption was decreased to below 650 W. The designed reaction canister could meet the requirements of the solid amine carbon dioxide removal system under microgravity.

Author

Design Analysis; Cans; Carbon Dioxide Removal; Desorption; Solidified Gases

20000114283 Institute of Space Medico-Engineering, Beijing, China

A Study of Low Temperature Catalyst for Sabatier Reaction

Ai, Shang-Kun, Institute of Space Medico-Engineering, China; Zhou, Ding, Institute of Space Medico-Engineering, China; Sun, Jin-Biao, Institute of Space Medico-Engineering, China; Hou, Wen-Hua, Institute of Space Medico-Engineering, China; Zhou, Kang-Han, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 277-280; In Chinese; Copyright; Avail: Issuing Activity

To develop a low temperature catalyst for the Sabatier CO₂ reduction of the atmospheric regeneration system and lower the start-up temperature of the Sabatier reaction. A low temperature catalyst was designed from the considerations of the active composition, the choice of the carrier, the production method and condition of the catalyst. Then the performance of the newly developed low temperature catalyst was tested. A new low temperature catalyst for the Sabatier reaction using Ru as the active composition and using r-A12O₃ as the carrier was developed. The start-up temperature was lower than 110 C and the start-up time was 8 min. The conversion efficiency of the lean component (H₂ or CO₂) was over 95 percent when the temperature of the reactor was from 200 C to 300C. The reaction product water was nearly colorless, transparent and neutral. The test results showed that the goals of the design are achieved and it is worthwhile to make further studies on the low temperature catalyst.

Author

Low Temperature; Catalysts; Carbon Dioxide; Sabatier Reaction; Energy Conversion Efficiency

20000114289 Institute of Space Medico-Engineering, Beijing, China

Manual Operation in Manned Spacecraft

Ma, Zhi-Jia, Institute of Space Medico-Engineering, China; Zhou, Qian-Xiang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Aug. 2000; ISSN 1002-0837; Volume 13, No. 4, pp. 301-304; In Chinese; Copyright; Avail: Issuing Activity

The main character of manned spacecraft is that there are astronauts in it. In order to ensure security, reliability and high efficiency of the whole system, it is necessary to make full use of human operation in space environment at the stage of system overall design, especially for long manned flight. On the basis of related data, this paper summarized the principles of manual operation, its main objects and some requirement on man-machine interface. At last, some views have been put forward for discussion. Key words: manned spacecraft; systems engineering; systems design; control systems; ergonomics; man-machine interfaces

Author

Aerospace Environments; Human Factors Engineering; Man Machine Systems; Reliability

20000114848 Massachusetts Inst. of Tech., International Center for Air Transportation, Cambridge, MA USA

Analysis of Complexity Evolution Management and Human Performance Issues in Commercial Aircraft Automation Systems *Final Report, 1 Jul. 1996 - 30 Jun. 2000*

Vakil, Sanjay S., Massachusetts Inst. of Tech., USA; Hansman, R. John, Massachusetts Inst. of Tech., USA; May 2000; 265p; In English

Contract(s)/Grant(s): NAG1-1857

Report No.(s): ICAT-2000-3; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

Autoflight systems in the current generation of aircraft have been implicated in several recent incidents and accidents. A contributory aspect to these incidents may be the manner in which aircraft transition between differing behaviours or 'modes.' The current state of aircraft automation was investigated and the incremental development of the autoflight system was tracked through a set of aircraft to gain insight into how these systems developed. This process appears to have resulted in a system without a consistent global representation. In order to evaluate and examine autoflight systems, a 'Hybrid Automation Representation' (HAR) was developed. This representation was used to examine several specific problems known to exist in aircraft systems. Cyclomatic complexity is an analysis tool from computer science which counts the number of linearly independent paths through a program graph. This approach was extended to examine autoflight mode transitions modelled with the HAR. A survey was conducted of pilots to identify those autoflight mode transitions which airline pilots find difficult. The transitions identified in this survey were analyzed using cyclomatic complexity to gain insight into the apparent complexity of the autoflight system from the perspective of the pilot. Mode transitions which had been identified as complex by pilots were found to have a high cyclomatic complexity. Further examination was made into a set of specific problems identified in aircraft: the lack of a consistent representation of automation, concern regarding appropriate feedback from the automation, and the implications of physical limitations on the autoflight systems. Mode transitions involved in changing to and leveling at a new altitude were identified across multiple aircraft by numerous pilots. Where possible, evaluation and verification of the behaviour of these autoflight mode transitions was investigated via aircraft-specific high fidelity simulators. Three solution approaches to concerns regarding autoflight systems, and mode transitions in particular, are presented in this thesis. The first is to use training to modify pilot behaviours, or procedures to work around known problems. The second approach is to mitigate problems by enhancing feedback. The third approach is to modify the process by which automation is designed. The Operator Directed Process forces the consideration and creation of an automation model early in the design process for use as the basis of the software specification and training.

Author

Aircraft Pilots; Airline Operations; Automatic Control; Behavior; Commercial Aircraft; Feedback; Human Performance

55

EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.

20000110068 NASA Johnson Space Center, Houston, TX USA

Martian Life: Evidence from Martian Meteorites

Gibson, Everett K., Jr., NASA Johnson Space Center, USA; [1999]; 1p; In English; Think Mars, 30 Sep. - 3 Oct. 1999, Cambridge, MA, USA; Sponsored by Massachusetts Inst. of Tech., USA

Contract(s)/Grant(s): RTOP 344-38-11-01; No Copyright; Avail: Issuing Activity; Abstract Only

In August 1996 our research team presented a chain of evidence within the ALH84001 meteorite which could be interpreted as signatures of relic Martian life. Additional research has shown that two additional Martian meteorites contain similar evidence.

Three SNC meteorites ranging in age from 4.5 Ga. to 1.3 Ga. to 165 m.y. contain features suggestive of past biogenic activity on Mars. Because we do not know what Martian life looks like or its physical or chemical properties, the only tools or criteria which the scientific community have to evaluate the evidence of past life on Mars is to use those used to evaluate the evidence for early life on Earth. The eight criteria established for evaluating evidence of early life on the Earth include: geologic context of the sample; sample's age and stratigraphic location; cellular morphology; colonies or biofilms biominerals or evidence of chemical disequilibria; stable isotope patterns unique to biology; presence of organic biomarkers; and proof that the features are indigenous to the sample. For acceptance of past life within terrestrial samples essentially most or all of these criteria must be met. The features within ALH84001's carbonate globules and the preterrestrial aqueous alteration phases in Nakhla and Shergotty have been interpreted as containing evidence of possible past life on Mars. Studies have shown conclusively that the reduced carbon components in ALH84001 and Nakhla are indigenous to the meteorites and are not terrestrial contaminants. Based on carbon isotopic compositions and mineralogical morphologies, there is no question or disagreement that the carbonate globules in Nakhla and Shergotty were formed on Mars. Possible microfossil structures and some reduced carbon components in the carbonates and preterrestrial aqueous alteration products, are therefore, almost certainly indigenous, but other possible evidence of life (e.g. amino acids) may be a result of terrestrial contamination. Our hypothesis of possible early life on Mars was presented three years ago and today we believe that it stands stronger than when originally presented. to date, no fatal strikes have been made on any of the original four lines of evidence. While details of the hypothesis are evolving as new data is generated, we believe that our basic premise remains intact: these meteorites contain evidence suggestive for early life on Mars.

Author

Mars (Planet); Extraterrestrial Life; SNC Meteorites; Amino Acids; Contaminants; Contamination

20000110336 NASA Johnson Space Center, Houston, TX USA

Evidence for Ancient Martian Life

Gibson, E. K., Jr., NASA Johnson Space Center, USA; Westall, F., NASA Johnson Space Center, USA; McKay, D. S., NASA Johnson Space Center, USA; Thomas-Keprta, K., NASA Johnson Space Center, USA; Wentworth, S., NASA Johnson Space Center, USA; Romanek, C. S., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Three SNC meteorites ranging in age from 4.5 Ga. to 1.3 Ga. to 165 m.y. contain features suggestive of past biogenic activity on Mars. Because we do not know what past martian life looks like or its physical or chemical properties, the only tools or criteria which the scientific community have to evaluate evidence of past life is to use evidence for early life on earth. There are features within ALH84001's carbonate globules and the preterrestrial aqueous alteration phases of Nakhla and Shergotty which have been interpreted as possible evidence for past life on early Mars. Additional information is contained in the original extended abstract.

Author

Extraterrestrial Life; Life Sciences; Mars (Planet); Meteoritic Composition; SNC Meteorites

20000110409 NASA Ames Research Center, Moffett Field, CA USA

Bringing Life to Mars

McKay, C. P., NASA Ames Research Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A suitable long-term goal for human exploration of Mars is the determination of whether or not a self-sustainable bio-sphere could be constructed on Mars, a process called Terraforming. Preliminary considerations of the conditions on a habitable Mars suggest that there are two potentially habitable states: one -characterized by an atmosphere of 1-3 bars of CO₂ - would be habitable for plants and microorganisms and another which would be habitable by humans. It may be possible to warm the planet by selective introduction of trace gases to enhance the greenhouse effect. Energy balance considerations suggest that warming Mars would take on the order of 100 years with a much longer time required to produce a breathable atmosphere.

Author

Atmospheric Composition; Energy Budgets; Mars Environment; Terraforming; Trace Elements

20000110410 NASA Johnson Space Center, Houston, TX USA

Possible Evidence for Life in ALH84001

McKay, David, NASA Johnson Space Center, USA; Gibson, Everett, NASA Johnson Space Center, USA; Thomas-Keprta, Kathie, Lockheed Martin Corp., USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from

CASI only as part of the entire parent document

Since our original paper in Science in August 1996, considerable new data has appeared from laboratories throughout the world, and our own team has had a chance to examine the sample in greater detail. The following summary touches on our original data and interpretation, and points out new data from us and from other groups, and the resulting changes and refinements in interpretations which we have made during the past three years. Additional information is contained in the original extended abstract.

Author

Data Acquisition; Planetary Environments; Extraterrestrial Life

20000110490 NASA Johnson Space Center, Houston, TX USA

An ESA Robotic Package to Search for Life on Mars

Westall, F., NASA Johnson Space Center, USA; Brack, A., NASA Johnson Space Center, USA; Clancy, P., NASA Johnson Space Center, USA; Hofmann, B., NASA Johnson Space Center, USA; Horneck, G., NASA Johnson Space Center, USA; Kurat, G., NASA Johnson Space Center, USA; Maxwell, J., NASA Johnson Space Center, USA; Ori, G. G., NASA Johnson Space Center, USA; Pillinger, C., NASA Johnson Space Center, USA; Raulin, F., NASA Johnson Space Center, USA; The Fifth International Conference on Mars; July 1999; In English; See also 20000110269; CD-ROM contains the entire conference proceedings presented in PDF format; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Similarities in the early histories of Mars and Earth suggest that life may have arisen on Mars as it did on Earth. The early life forms on Mars were probably simple organisms, similar to terrestrial prokaryotes. In fact, given the early deterioration of the Martian climate, it is unlikely that life on Mars could ever have reached more sophisticated evolution. Based on the present knowledge of Mars, the possibility of extant life at the surface is small. However, given the adaptability of terrestrial prokaryotes under adverse conditions, it is not excluded. Any extant life is hypothesized to reside in the permafrost in a dormant state until "reanimated" by impact-caused hydrothermal activity. Using this rationale, a group of European scientists worked together to conceive a hypothetical strategy to search for life on Mars. A possible configuration for a lander/rover is outlined.

Derived from text

Extraterrestrial Life; Mars (Planet); Mars Environment; Organisms; Exobiology; Roving Vehicles

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